WATER WORKS & SEWERAGE

HARRY E. JORDAN

WATER WORKS "MAN OF THE YEAR"

Thousands of hospital patients endangered

but Perchloron

REG. U.S. PAT. OFF.

saved the day!

A TRUNK SEWER was under construction across the property of a large hospital taking care of thousands of patients. To facilitate the work one of the supply lines from the hospital's private water supply was temporarily opened.

Later, while driving steel shoring, the contractor pierced a cast iron sewer line lying a short distance from the opened water line. There was no flow from the sewer line and it was presumed to be dead.

However, the next morning seepage was discovered at the hospital water stations. Investigation showed that the cast iron line carried sewage intermittently—and it had contaminated the water supply!

Portable hypochlorite feeders were rushed from the filtration plant and connected at the pumping stations of the hospital. Per*chlor*on was fed at a very high rate throughout the night and after high residuals were obtained at every spigot and extremity, the water was passed as safe for consumption.

The hospital reported no illness that might have resulted from sewage pollution. The prompt use of Per*chlor*on removed the threat of disease and quickly made the system safe.

Per*chlor*on, with over 70% available chlorine, proves a remarkably effective standby for emergencies. Its ready solubility, greater stability and high chlorine content have won wide preference for Per*chlor*on among water works engineers.

Because large quantities of Per*chlor*on are in urgent demand for current army and navy use, we ask our old customers to cooperate with us by ordering Per*chlor*on only for their usual immediate needs—*well in advance!* Today's conditions present many unusual problems—if you want technical assistance, get in touch with a Penn Salt representative . . . Send today for your *free* copy of a valuable data book on the use of Per*chlor*on. Pennsylvania Salt Manufacturing Company, 1000 Widener Building, Philadelphia, Pa. Branch Offices: New York • Chicago • St. Louis • Pittsburgh • Wyandotte • Tacoma.

PENN SALT
Chemicals

WE feel that, for the duration, it is our responsibility to serve to the best of our ability on two fronts. To accomplish this we are making our manufacturing facilities do double duty. Our primary concern is, of course, to give our armed forces every possible aid by manufacturing those direct instruments of war which we are best equipped to produce. To this end, a major portion of our facilities has been allocated to the needs of the military services.

At the same time, we are honor bound to continue serving the water works industry which is so vital to the public well-being. Meters and meter parts are necessary for the continued efficient operation of water plants. Their use avoids waste and conserves many times the small amount of critical materials needed in their construction by reducing the necessity for additional pipelines, pumping equipment, purification and reservoir facilities.

For the duration, therefore, we shall consider ourselves serving on two fronts. In performing this dual task, every employee of the Pittsburgh Equitable Meter Company has but one object in view—to speed the day of Victory. Our share in this supreme effort may seem small, but multiplied country-wide, it can and will assure the continued benefits of freedom to all.

THE *Empire* VICTORY METER

The Empire Victory and the Pittsburgh Ironside are meters designed not only for war *but for wear*. Both have fully rustproofed cast iron outer cases; both are fitted with the Pittsburgh-National developed molded glass register box; both conserve over 70% of the bronze normally used in the construction of meters of this size.

The Empire Victory Meter employs the time-tested oscillating piston principle of measurement, using the famous Empire balanced piston. The Pittsburgh Ironside Meter is of the widely used disc type with inner-working mechanism proven in thousands of Pittsburgh Arctic and Tropic Meters. Both are accurate measuring instruments, each possessing its own individual characteristics. Together they provide the necessary types to handle practically every domestic meter requirement or preference of water works men.

THE PITTSBURGH IRONSIDE METER

PITTSBURGH-NATIONAL METERS

THE MOST COMPLETE LINE OF WATER METERS IN THE WORLD

PITTSBURGH EQUITABLE METER COMPANY

NEW YORK · BROOKLYN · DES MOINES · MEMPHIS · OAKLAND · TULSA · CHICAGO · BOSTON

MERCO-NORDSTROM VALVE COMPANY
Main Offices, Pittsburgh, Pa.
NATIONAL METER DIVISION, Brooklyn, N. Y.

KANSAS CITY · PHILADELPHIA · SAN FRANCISCO · LOS ANGELES · SEATTLE · HOUSTON · COLUMBIA · BUFFALO

WATER WORKS & SEWERAGE, January, 1943. Volume 90, Number 1. Published monthly by Gillette Publishing Co., 330 South Wells Street, Chicago, Ill. Per copy, 25c. Subscription rate, United States, $2.00 per year; Canada, $2.00 per year; Foreign, $3.00 per year. Entered as Second Class Matter, June 2, 1931, at the Post Office at Chicago, Ill., under Act of March 3, 1879.

Pure Water
vitally important
in civilian
morale
Your critical part in maintaining an adequate supply of pure water is recognized as an extremely important contribution to the war effort.
Among experienced water works engineers everywhere, Diamond Liquid Chlorine has been long regarded as the standard of purity, uniformity and quality.
ALKALI
DIAMOND
ALKALI
COMPANY
Pittsburgh, Pa., and Everywhere
CHLORINE

"IF THOSE PLANES WERE HOSTILE WE'D SURE BE GRATEFUL FOR MATHEWS HYDRANTS"

A winter air raid could be a frightful thing. But Mathews Hydrants would give their town several real advantages. Fire would find them ready in the bitterest weather, for a properly set Mathews cannot freeze. Explosion would find them strong, for the Mathews has no breakpoint. But the greatest single advantage would be their speedy repair in case of ruinous destruction. For all operating parts of a Mathews hydrant can be unscrewed and replaced from above ground—with no digging in frozen ground. That's important in these days of labor shortage.

A Mathews-protected area has every protection that fire hydrants can give.

MATHEWS HYDRANTS

400 CHESTNUT STREET, PHILADELPHIA, PA.

ESTABLISHED IN 1803

Made by R.D. WOOD Company

MANUFACTURERS OF SAND SPUN PIPE (CENTRIFUGALLY CAST IN SAND MOLDS) AND R. D. WOOD GATE VALVES

THIS STORM SEWER is fighting on two fronts

This and other storm sewers are doing an important job at home without the use of critical materials — thanks to ARMCO Emergency Wood Pipe. The metal it releases may even now be helping to save lives and shorten the war on a distant fighting front.

Yes, essential wartime drainage can be taken care of economically, efficiently and *patriotically*. The new design of ARMCO Emergency Pipe requires no steel sheets and bands, wire mesh, metal reinforcing or other critical material. Skilled labor is not needed. The pipe is easy to handle and install. Also important now, ARMCO Pipe is light in weight and nestable, which often means up to 80 per cent savings in transportation.

Remember that ARMCO Corrugated Metal Pipe is only on temporary "leave of absence." It will be back after the war with its flexible strength, long lengths, tight joints and low installation costs. Meanwhile, steel must not be used in any drainage structure unless engineering integrity demands it. For most of those wartime "must" jobs you'll find a highly practicable substitute in ARMCO Emergency Wood Pipe. Write us today for complete information. Address: ARMCO Drainage Products Association, 75 Curtis Street, Middletown, Ohio, U. S. A.

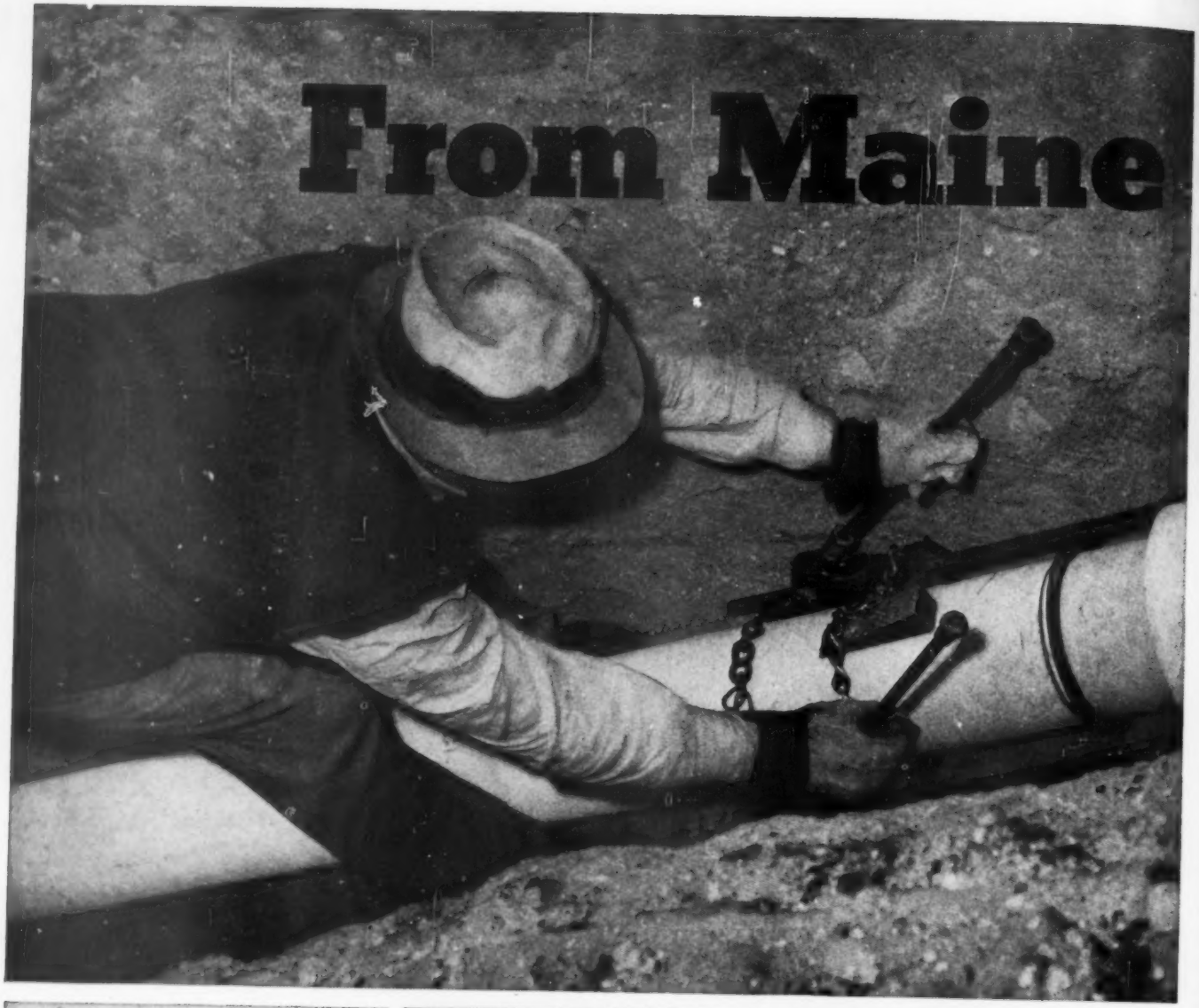
ARMCO **EMERGENCY PIPE**

U.S. cast iron PIPE

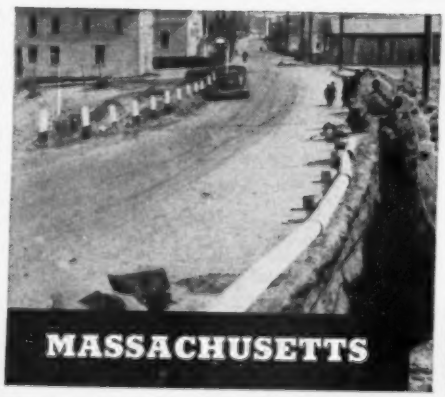
S. PIPE & FOUNDRY CO.
neral Offices: Burlington, N. J.
lants and Sales Offices throughout the U. S. A.

By metallurgical controls and analysis of raw materials, we know *physical characteristics* of the iron used in making Super-de Lavaud Pi The pipe is cast centrifugally in a metal mold and heat treated to incre toughness and assure uniformity of metal structure. The finished p is subjected to a regularly scheduled series of rigid tests. By these meth and controls, a high standard is attained and maintained—of me strength, ductility and impact-resistance.

Lithographed on stone by Edward A. Wilson for U. S. Pipe & Foundry Co.


From Maine

MAINE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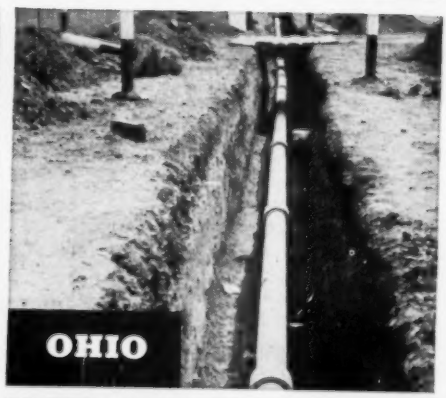
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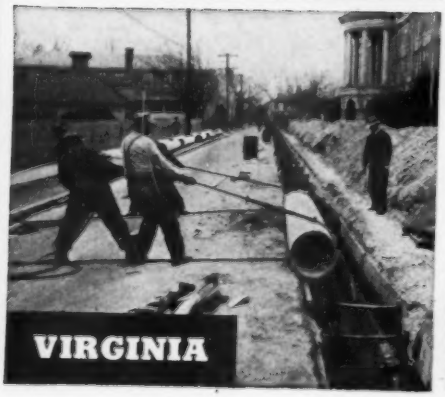

VIRGINIA

MISSOURI

to California . . .

ALL OVER THE COUNTRY, J-M Transite Pipe has steadily gained in use *for civilian water lines*. Now, virtually all new Transite Pipe goes into water transmission and distribution systems in camps, bases and war plants. For civilian *or* military use, these features of Transite Pipe mean efficient, low-cost water transportation:

No Tuberculation. Transite cannot tuberculate, because it is non-metallic. Its flow-coefficient is high initially (C=140) and in service.

Quickly Assembled. Even unskilled crews can form tight joints without difficulty with the Simplex Coupling. No heating or pouring required.

Easy to Handle. Light in weight . . . requires fewer men for handling . . . and only the larger sizes require mechanical handling equipment.

Low Maintenance. Made of asbestos-cement, Transite's inherent corrosion-resistance and maintained strength are important features in contributing to low maintenance costs.

Tight, Flexible Joints. The modern Simplex Coupling retains its tightness even when deflected as much as 5° at each joint, permitting wide sweeps with straight lengths.

For details on Transite Pressure Pipe, write for brochure TR-11A. Information on Transite Sewer Pipe for lower cost sewage-disposal systems is available on request—brochure TR-21A. Johns-Manville, 22 East 40th Street, New York, N. Y.

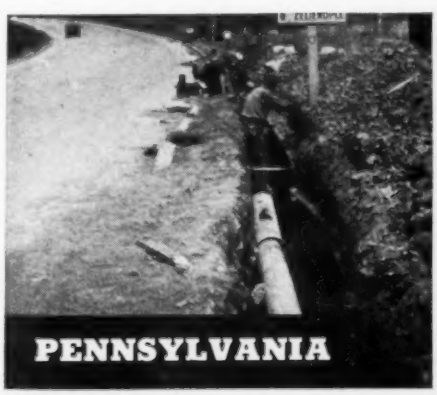
Johns-Manville

JOHNS-MANVILLE JM PRODUCTS

Transite Pipe

AN ASBESTOS PRODUCT

FOR EFFICIENT, ECONOMICAL WATER AND SEWER LINES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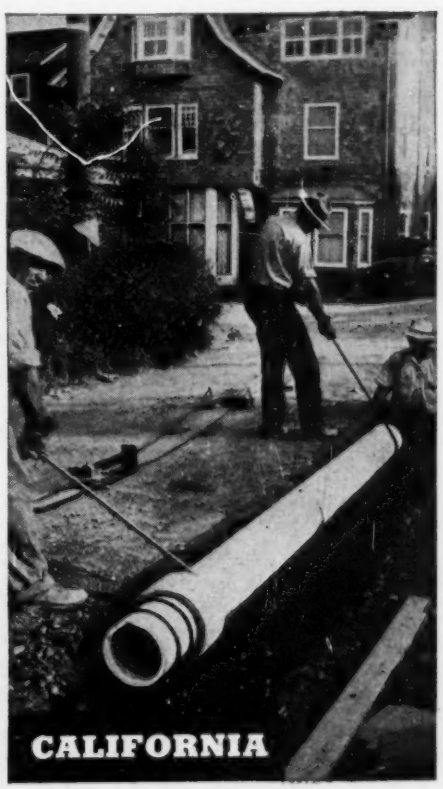
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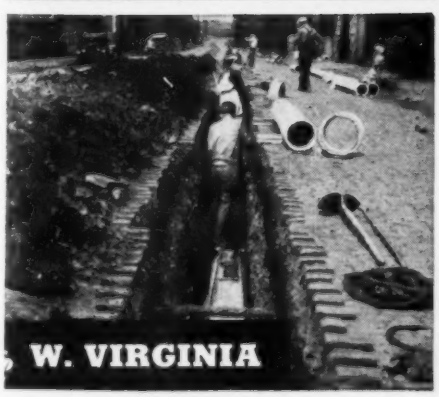
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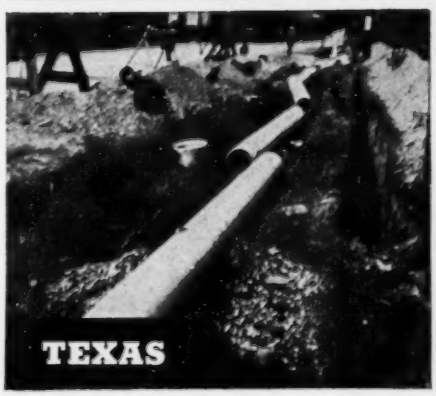

TEXAS

THEY COULDN'T FIND THE CAUSE, BUT *Cathodic Protection* STOPPED THE TROUBLE

These aeration tanks at the Jackson, Michigan, sewage treatment plant are equipped with Aluminum Alloy diffuser plate holders.

Aluminum Alloy diffuser plate holders in these sewage aeration tanks were behaving fine, in general. But here and there, a few of them were being attacked. Good holders put in their places were similarly attacked, demonstrating that the trouble had something to do with location rather than with the metal.

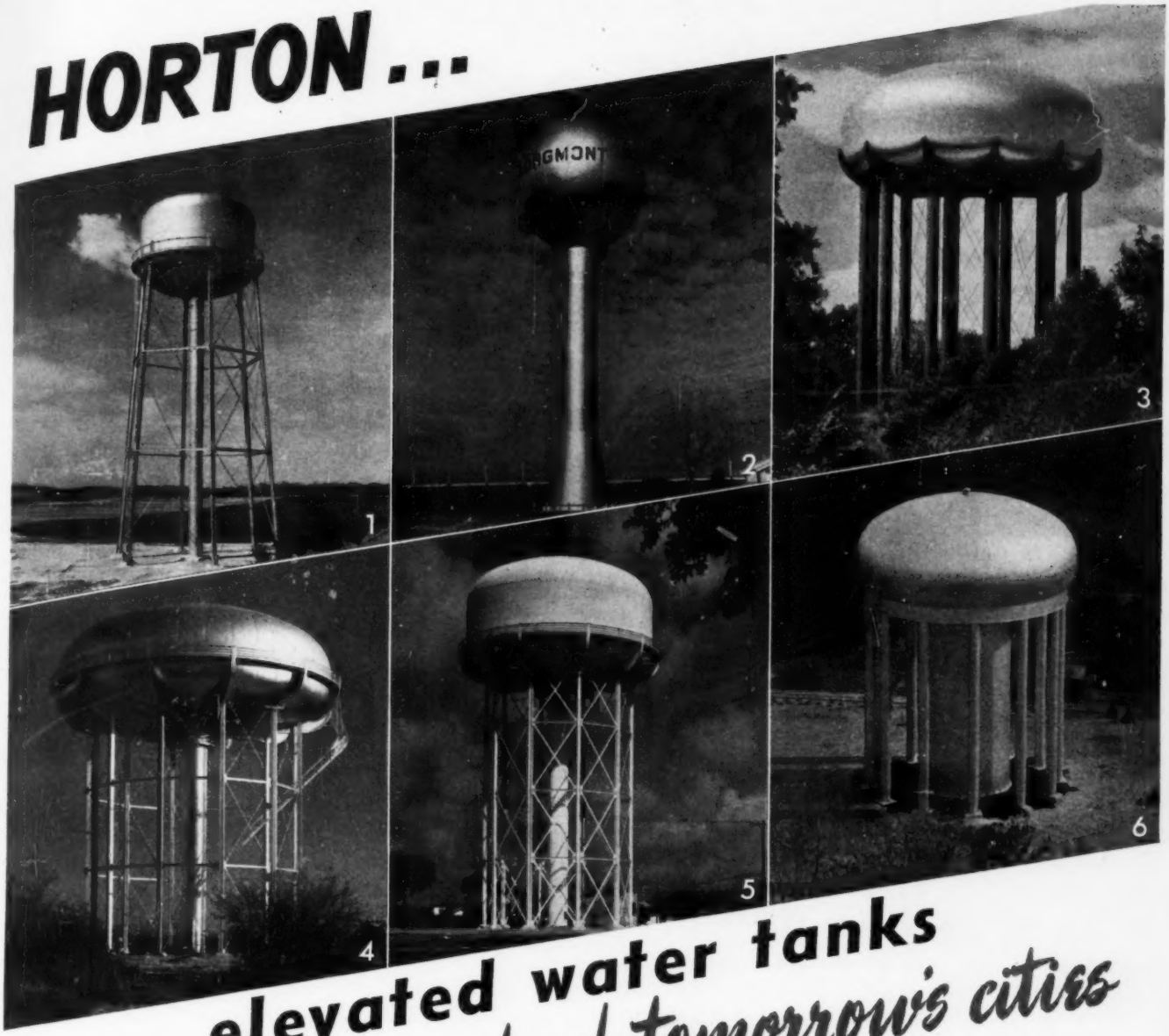
Attempts were made to isolate the troublemaker without much luck, except that it did look like electrolysis. Finally, zinc strips were attached to the Aluminum holders at those locations where trouble showed up, and the attack was stopped.

Aeration tanks are emptied and all the diffuser plate holders are inspected about every six months. Corroded zincs are replaced and new strips are installed if any other points of attack are uncovered. Cathodic protection is doing the trick.

Alcoa engineers are anxious to assist you similarly to help make irreplaceable Aluminum Alloy equipment last longer. Years of research enable them to advise you on cathodic and other methods of protection. For this help, write ALUMINUM COMPANY OF AMERICA, 1955 Gulf Building, Pittsburgh, Pennsylvania.

ALCOA ALUMINUM

HORTON . . .



. . . elevated water tanks *to meet the needs of tomorrow's cities*

1 This Horton elevated tank provides gravity pressure in the water supply system at Mansfield, Ohio.

2 100,000-gal. Watersphere, 60 ft. to bottom, installed in the Longmont, Colorado water supply system.

3 "Streamlined" elevated tank installed at Indianapolis, Ind. It has a capacity of 1,500,000 gals.

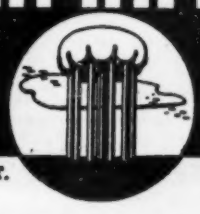
4 1,000,000-gal. Horton radial-cone bottom elevated storage tank at Tucson, Arizona.

5 Attractive 1,000,000-gal. Horton radial-cone bottom tank at Beaumont, Texas.

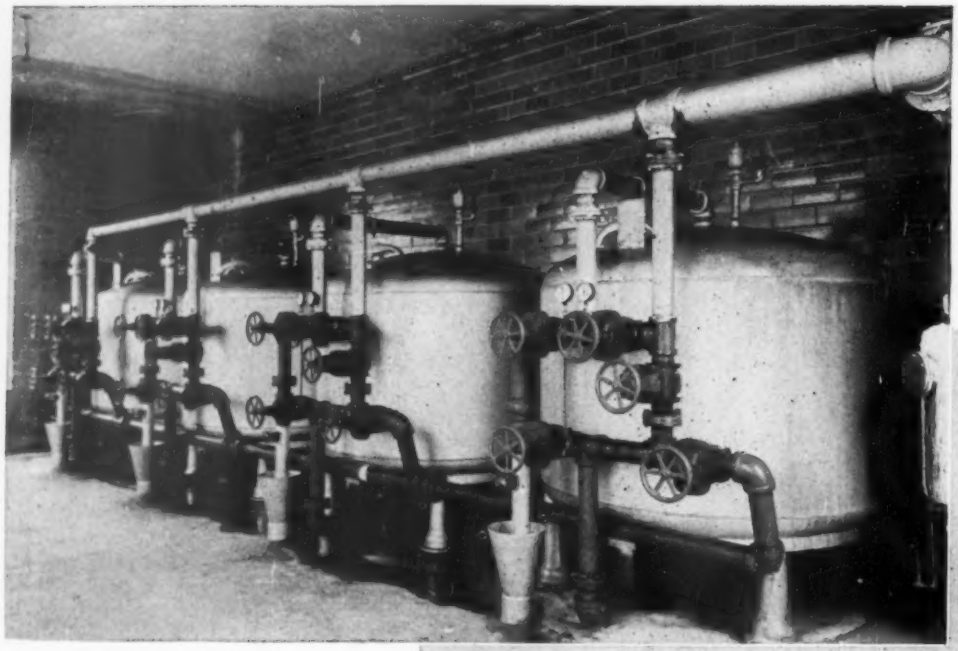
6 1,000,000-gal. spheroidal design elevated tank at Jonesboro, Arkansas.

CHICAGO BRIDGE & IRON COMPANY

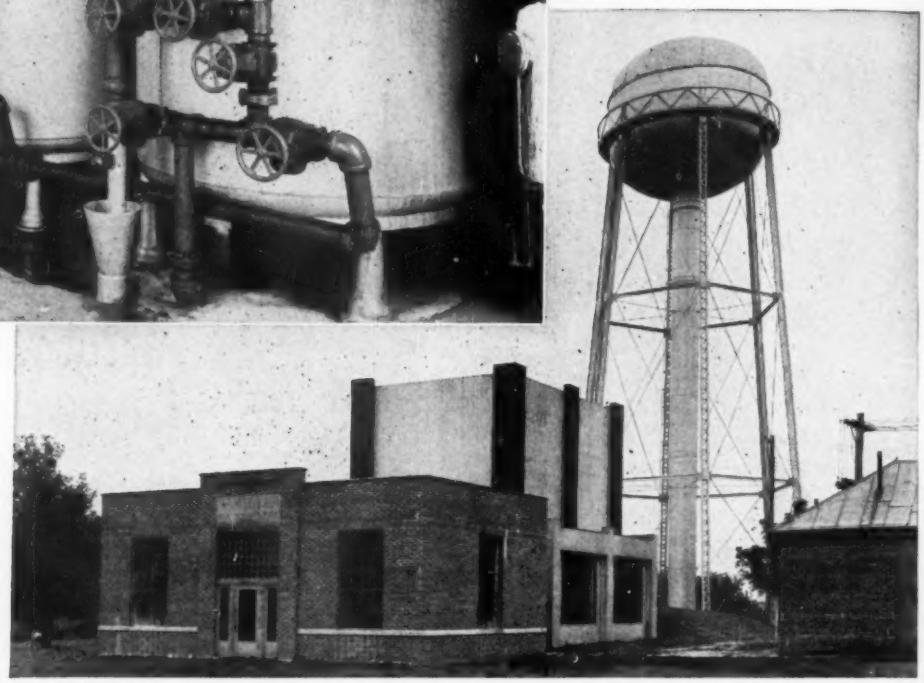
Chicago.....2198 McCormick Bldg.	Birmingham..1586 North 50th Street	Philadelphia...1644-1700 Walnut St.
New York.3390-165 Broadway Bldg.	Tulsa.....1646 Hunt Bldg.	Washington.....330 Bowen Bldg.
Cleveland.....2262 Guildhall Bldg.	Houston.....5615 Clinton Drive	San Francisco.....1083 Rialto Bldg.
Havana.....402 Edificio Abreu		Greenville.....York Street



Plants at BIRMINGHAM, CHICAGO, and GREENVILLE, PA. *In Canada:* HORTON STEEL WORKS, LIMITED, FORT ERIE, ONT.



(Left) The four Graver Iron Removal Filters installed in parallel. (Below) Exterior of the pumping and filtering works.



GRAVER

licks another tough iron removal job

A Minnesota municipal water plant has as its water supply one 12", 600 foot well and one 10", 400 foot well with a total output of 144,000 gallons per day. The water contains an unusually large amount of iron, which was evidenced by heavy stains in sinks and toilet bowls.

PROBLEM: How to remove the iron from the water supply most efficiently and economically.

SOLUTION: The installation of a Graver Pressure Type Iron Removal System consisting of a Pressure Aerator and four Graver Iron Removal Filters installed in parallel and having a capacity of 100 gallons per minute.

RESULTS: The Superintendent reports that since the installation was made there has been absolutely no trace of iron in the water and no further staining of sinks and toilets. He also states that the cost of operation is extremely low.

Whatever your water conditioning problem may be, you'll find it worth while to consult Graver.

WATER SOFTENERS
FILTRATION SYSTEMS
CLARIFIERS
SEWAGE EQUIPMENT
STEEL STORAGE TANKS
VAPOR CONSERVATION SYSTEMS
WELDED CONSTRUCTION
STRESS RELIEVING
X-RAYING
FABRICATED STEEL AND CORROSION-RESISTING PLATE

GRAVER

GRAVER TANK & MFG. CO., INC.

NEW YORK
CATASAUQUA, PA.

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CABLE ADDRESS — GRATANK

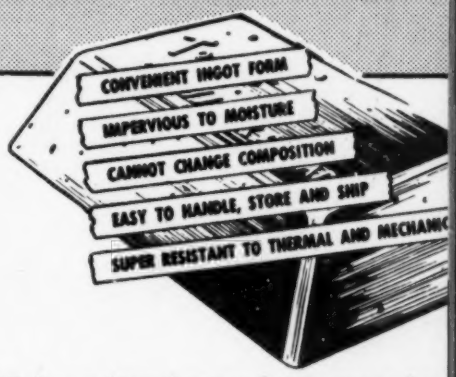
CHICAGO
TULSA

43-S-W

Sound Chemical and Engineering Experience

combined to make this a

BETTER BELL & SPIGOT MAIN JOINTING COMPOUND


CONVENIENT INGOT FORM
IMPERVIOUS TO MOISTURE
CANNOT CHANGE COMPOSITION
EASY TO HANDLE, STORE AND SHIP
SUPER RESISTANT TO THERMAL AND MECHANIC

T*egul*-MINERALEAD is a plasticized sulphur compound which includes a specially prepared olefine polysulphide that serves as a plasticizing agent. In the Laying of Bell & Spigot Main *Tegul*-MINERALEAD's advantages have won it wide and constantly growing favor for, besides making permanently tight joints, *Tegul*-MINERALEAD is a time and labor saver and promotes sound economies in both laying and maintenance.

In addition to the advantages listed below, *Tegul*-MINERALEAD has better aging qualities, higher resistance to vibration, mechanical shock and temperature changes, greater plasticity, and a lower coefficient of expansion than have unplasticized sulphur cements.

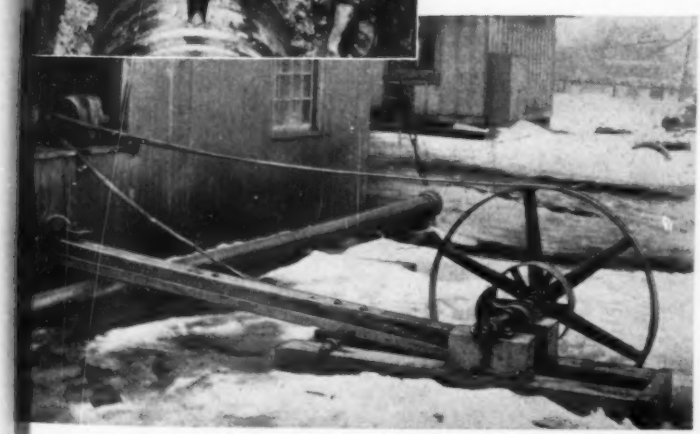
Tegul-MINERALEAD has achieved general acceptance by state and municipal departments and water works engineers. Th use it once continue to specify *Tegul*-MINERALEAD because its tages are, in total, unmatched in any other compound for its p

Tegul-MINERALEAD is available, being stocked at convenient points noted below. Incidentally — using *Tegul*-MINERALEAD, you help conserve lead, a strategic war metal.
Write for further information.

•

1. Our technical literature includes the story of the Wichita Water Supply Project — 33 miles of Bell & Spigot Main (including 22 miles of 48" diameter pipe) completed and in service in 38 weeks. Specifications allowed max. leakage of 100 gals., per inch diameter, per mile, per day. *Actual* leakage two weeks after water was turned into line was 39 gals., per inch diameter, per mile, per day. *Tegul*-MINERALEAD (325,000 lbs.) was the jointing compound used.

2. To see what sort of punishment jointing with *Tegul*-MINERALEAD can really take, we joined two 12' lengths of 4" Bell & Spigot pipe to form a span 19' between supports. Joint was centered under power hammer beam with 50 lb. iron chunk head. This "hammer" delivered 90,000 smashing impacts in 15 hours of continuous action. Throughout the test 90 lbs. water pressure was maintained in the pipe and at the end there wasn't even a suspicion of leakage.



Only Tegul-MINERALEA

offers all this:

- MUCH LOWER INITIAL LEAKAGE and what there is seals in much less t This permits immediate back-filling clearing up, with corresponding reduc in traffic hazards.
- 10 LB. INGOT FORM — So conven to handle, ship and store.
- IMPERVIOUS TO MOISTURE — May stored in the open in any weather. affected by rain, snow or flood.
- PROOF AGAINST COMPOSITI CHANGE which may happen with pounds in some forms, due to joltin transit. *Tegul*-MINERALEAD reaches of use exactly as it leaves factory.
- NEEDS NO SKILLED LABOR, caul or deep bell holes.

Tegul-MINERALEAD

The ATLAS MINERAL Products Company
OF Mertztown PENNA. Pennsylvania

The House Jointing Materials

*ATLANTA, Ga. 175 Spring St., S.W.
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*DALLAS, Tex. 3921 Purdue Street
*DETROIT, Mich. 2970 W. Grand Blvd.
*KANSAS CITY, Kan. 1913 Tauromee Av
NEW YORK CITY, 280 Madison Ave.
PITTSBURGH, Pa. (10)4656 Old Bosto
TORONTO, Ont., McRae Engineering E ment, Ltd. 11 King St.,

The ATLAS MINERAL Products Company of California
REDWOOD CITY, California

*DENVER, Colorado, 1921 Blake Street
*HONOLULU, Hawaii, U.S.A.
*LOS ANGELES, Cal., 817 Yale Street
*SEATTLE, Wash., H. D. Fowler Compar 558 First Avenue, Sou

*Stocks carried at these points

The eyes of all America are upon the United States Treasury Roll of Honor appearing in the "Payroll Savings News." For copy write War Savings Staff, Treasury Department, Washington, D. C.

HOW TO "TOP THAT 10% BY NEW YEAR'S"

Out of the 13 labor-management conferences sponsored by the National Committee for Payroll Savings and conducted by the Treasury Department throughout the Nation has come this formula for reaching the 10% of gross payroll War Bond objective:

1. ***Decide to get 10%.***
   It has been the Treasury experience wherever management and labor have gotten together and decided the job could be done, the job was done.
2. ***Get a committee of labor and management to work out details for solicitation.***
   a. They, in turn, will appoint captain-leaders or chairmen who will be responsible for actual solicitation of no more than 10 workers.
   b. A card should be prepared for each and every worker with his name on it.
   c. An estimate should be made of the possible amount each worker can set aside so that an "over-all" of 10% is achieved. Some may not be able to set aside 10%, others can save more.
3. ***Set aside a date to start the drive.***
4. ***There should be little or no time between the announcement of the drive and the drive itself.***
   The drive should last not over 1 week.
5. The opening of the drive may be through a talk, a rally, or just a plain announcement in each department.
6. Schedule competition between departments; show progress charts daily.
7. Set as a goal the Treasury flag with a "T."

AS of today, more than 20,000 firms of all sizes have reached the "Honor Roll" goal of at least 10% of the gross payroll in War Bonds. This is a glorious testimony to the voluntary American way of facing emergencies.

But there is still more to be done. By January 1st, 1943, the Treasury hopes to raise participation from the present total of around 20,000,000 employees investing an average of 8% of earnings to over 30,000,000 investing an average of at least 10% of earnings in War Bonds.

You are urged to set your own sights accordingly and to do all in your power to start the new year on the Roll of Honor, to give War Bonds for bonuses, and to purchase up to the limit, both personally and as a company, of Series F and G Bonds. (Remember that the new limitation of purchases of F and G Bonds in any one calendar year has been increased from $50,000 to $100,000.)

TIME IS SHORT. Our country is counting on you to—

"TOP THAT 10% BY NEW YEAR'S"

EVERYBODY EVERY PAYDAY AT LEAST 10%

Save with

War Savings Bonds

This space is a Contribution to America's All-Out War Effort by WATER WORKS AND SEWERAGE

the Promise
OF AMERICA

America has always been a land of promise, but never more so than today. In the past it has been mainly a promise to individuals seeking freedom and opportunity. Today it is a promise to nations. For in the freedom of the individual we have found the way by which nations may become strong and free, not at the expense but to the benefit of other nations.

Niagara has always been an expression of America's great resources and unlimited opportunities. It is also a symbol of friendship and cooperation because its power and beauty are shared equally with a country that has grown and prospered and remained free as a neighbor of America. Here is the vision and the substance of Democracy—the proof of history that decency among nations is as fruitful as decency among men. It is also proof of the fact that mutual respect is a source of self-respect and a basis for the lasting peace for which all nations hope.

We who work within sight and sound of Niagara Falls are devoting every ounce of our energies and facilities to speeding the flow of chemicals for Victory.

CAUSTIC POTASH · CAUSTIC SODA
PARA · CARBONATE OF POTASH
LIQUID CHLORINE

FROM THE ORIGINAL BY JOHN S. DeMARTELLY . . . IN NIAGARA ALKALI COMPANY'S COLLECTION OF PAINTINGS OF NIAGARA FALLS

NIAGARA ALKALI COMPANY

Niagara ALKALI COMPANY

60 EAST 42nd STREET, NEW YORK, N. Y.

An Essential Part

America's G

Chemical Enterp

FOR OVER 50 YEARS

Sincerely yours *

HAS BEEN PROUDLY INSCRIBED, IN EFFECT IF NOT IN FACT, ON THOUSANDS OF BUILDERS FLOW METERS AND CONTROLLERS!

OLD GLORY

and the Army-Navy "E" Pennant

fly above our foundries and shops where the wheels of industry are humming night and day in the united effort for freedom's preservation.

More permanent, however, than the products for war are BUILDERS VENTURI METERS, VENTURI CONTROLLERS, and CHRONOFLO TELEMETERS in the water supply systems and purification plants throughout the United States. Day in and day out, they play a vital role in the economical production and conservation of the water supply

* Back in the old days, second-rate Roman sculptors who made unsightly nicks in the marble would secretly patch up the flaws with a mixture of wax and marble dust. These patches would drop out later on and honest artists suffered so much that they began labelling their handiwork "Sine Cera" (i. e. "Without Wax"); from this we derive our word "sincere" meaning honest, genuine, real.

ARMY E NAVY
AWARDED
AUG. 1st, 1942

BUILDERS-PROVIDENCE, INC.

Est. 1820 • DIVISION OF BUILDERS IRON FOUNDRY • *Inc. 1853*

37 CODDING STREET • PROVIDENCE, R. I.

BUILDERS
WATER AND SEWAGE WORKS
Equipment

WHAT IS YOUR CHEMICAL FEEDING PROBLEM?

Whether your water system is pumped or gravity flow, low or high pressure, % Proportioneers, Inc. % is prepared to furnish you with equipment and service on all your Chemical Feeding (chlorination, ammoniation, calgon, soda ash, lime, alum, etc.) and Proportioning Problems. You are obligated in no way if you send for bulletin information, engineering recommendations, or quotations from

"CHEMICAL FEEDER HEADQUARTERS."

For Pumped Water Systems
Constant Rate Feeders
Manual Adjustment

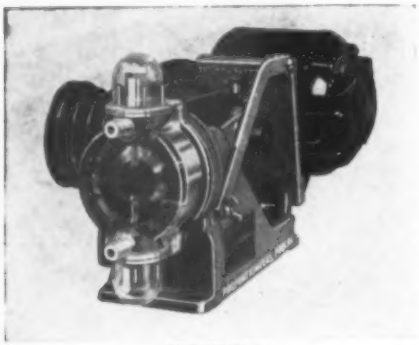

FIGURE 1

FIGURE 2

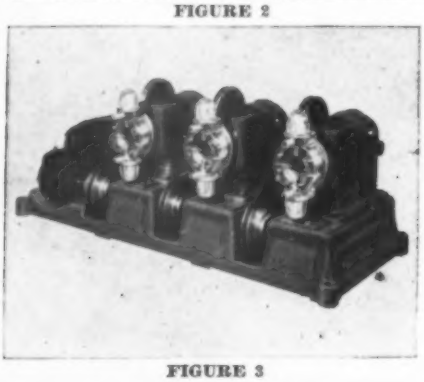

FIGURE 3

Fig. 1—Heavy Duty Midget Chlor-O-Feeder

Fig. 2—Duplex Multi-control Feeder

Fig. 3—Triplex Multi-control Feeder

Fig. 4—High Pressure Midget Chem-O-Feeder

Fig. 5—Low Pressure Chem-O-Feeder

Fig. 6—High Pressure Chem-O-Feeder

Fig. 7—Belt Shifter Heavy Duty Midget Chlor-O-Feeder

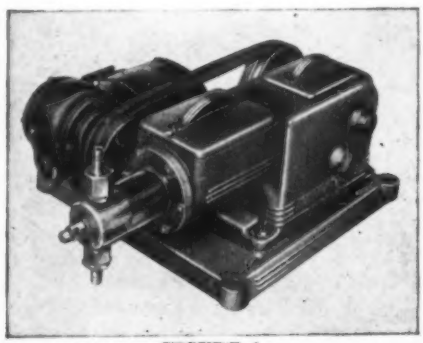

FIGURE 4

For Gravity Flow Systems
Flow Proportional Feeder
Automatic Adjustment

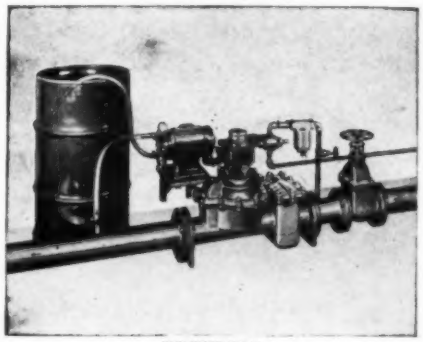

FIGURE 5

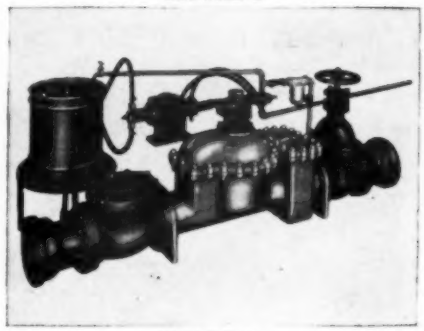

FIGURE 6

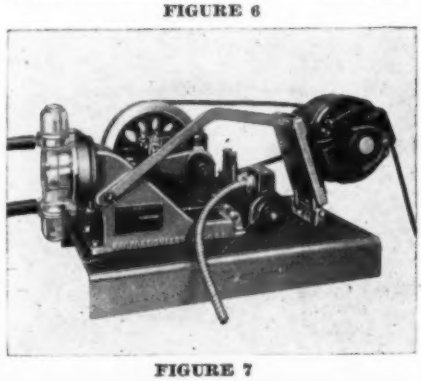

FIGURE 7

9N CODDING ST. % PROPORTIONEERS, INC. % PROVIDENCE, R. I.

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San Francisco, Cal.
Seattle, Wash.
Syracuse, N. Y.
Troy, N. Y.
Tulsa, Okla.
Worthington, Ind.
Washington, D. C.

WATER WORKS & SEWERAGE

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E. S. Gillette, Publisher

EDITORIAL OFFICE
155 East 44th Street, New York, N. Y.
L. H. Enslow, Editor

COMING!

"Progress in Sewage and Industrial Waste Treatment"

Is the annual review of developments and progress in sewerage practices, and sewage and industrial waste treatment during the year 1942, which is to be featured in February. The authors are—
PROF. CHAS. GILMAN HYDE,
University of Calif.
A. M. RAWN, Los Angeles, Calif.

"Re-establishing the Designed Capacity of a Vital Flow Line"

Is another one of those "stretch" stories involving a successful measure employed to restore the delivery capacity of a vital 36-mile transmission main called upon to supply military needs. The experience is another success story for chlorination, in which an heroic short term dosage stripped the 39-in. reinforced conduit of its flow impeding biological film. The account is told by—
L. A. JACKSON, Manager,
and
W. A. MAYHAN, Chemist,
Little Rock (Ark.) Water Works.

DIGESTER HEATING

On this important topic two articles by designing and operating engineers have been scheduled.

"Scrubbing Digester Gas"

Is the story of a plant superintendent relating method adopted for removing sulphides and other impurities from digester-gas by scrubbing, and a description of the scrubbing units. The author is—
H. E. MORRIS, Plant Superintendent,
Peru, Indiana.

"Cleaning Corroded Metal Surfaces by Flame-Priming"

Is a report on the successful use of the acetylene torch method of dehydrating tubercules, rust and other corrosion products, as a means of cleaning the surface preparatory to application of protective coatings, painting, etc. The scheme is known as "Flame Priming" and its application and results will be described by—
PAUL WEIR, Ass't General Manager,
Water Department, Atlanta, Ga.

"Why Dirty Filters?"

Is the title of an article that discusses filter media and filter washing from the standpoint of producing a filter which will wash clean and keep that way. The author is—
HERBERT E. HUDSON, Engineer,
Dept. of Public Works, Chicago.

"Sampling Errors at Water and Sewage Plants"

Is a paper, the title of which is self-descriptive. It discusses the importance of representative sampling and what errors in sampling may amount to in revealing a false picture of operating results. The contributor is—
DR. HAROLD A. THOMAS, JR.,
School of Engineering, Harvard University.

"Sludge Bulking Control"

Is a recital of experience with mild chlorination of returned sludge, during a number of summers, for the purpose of controlling sludge bulking. The author is—
E. E. SMITH, Supt. of Water and Sewage,
Lima, Ohio.

VOL. 90, NO. 1

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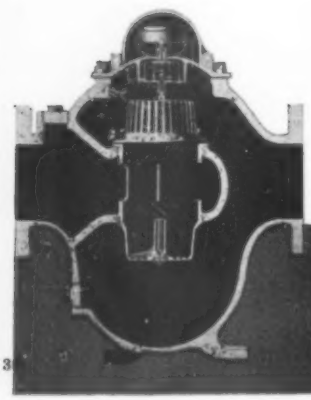
Trident Crest Meters are recommended by leading Water Works officials for their ability to produce maximum revenue on high rates of flow over long periods of time. Their accuracy and durability are the result of their basically correct design, simplicity and rugged construction.



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WATER WORKS & SEWERAGE

VOL. 90, No. 1 *A Gillette Publication* JANUARY, 1943

DEVELOPMENTS OF THE YEAR IN WATER SUPPLY

A Review

By W. VICTOR WEIR
Superintendent
ST. LOUIS COUNTY WATER CO.
UNIVERSITY CITY, MO.

***NINETEEN FORTY-TWO** may be summed up with the one word—WAR! War, with dislocations and new problems; war, with its increasing necessity for maintained water systems and increased water output; war, with its drain on manpower and materials.*

Teamwork has been called for; not teamwork of individuals, but teamwork of teams. The water supply industry has been one of these teams. Its work has been creditable and representative of the integrity of waterworks operators who have always been ready to shoulder responsibilities as they come. This team work of water works men as a whole has been the outstanding development of the year.—W. V. W.

The Author

THE greatest accomplishment in 1942 has been that important service to all water works men performed by the AWWA Committee on Wartime Activities, Louis R. Howson, Chairman, Boyd A. Bennett, Eugene F. Dugger, John A. Kienle, Abel Wolman and Harry E. Jordan, Executive Secretary of AWWA, as the "mainspring." They have worked "to obtain accurate data concerning the materials and supply situation within the water supply field; to present the situation to the proper authorities in Washington and obtain such rulings as may be possible; and to transmit the information thus obtained to the water works management field." That the task has been well done is evidenced by the fact that the water supply industry is hampered by fewer restrictions than any other industry. The basic and indispensable character of water supply has been recognized by the War Production Board, and significant is the fact that the individual utilities comprising the industry have virtually been placed "on their honor" with a minimum of compliance policing.

Harry Jordan must be singled out individually as the "Water Works Man of the Year." As liaison man and ambassador for the water works industry he has capably represented it to the Washington authorities, whose business it was to see that each industry was allowed to function in relation to its importance in the National interest. Functioning as a "clearing-house," he has interpreted for, advised and educated water works operators as to their important position in the Nation's wartime efforts. Also, through his efforts, more than any other, the American Water Works Association, the backbone of the water supply industry, has grown to a membership of over 4,500.

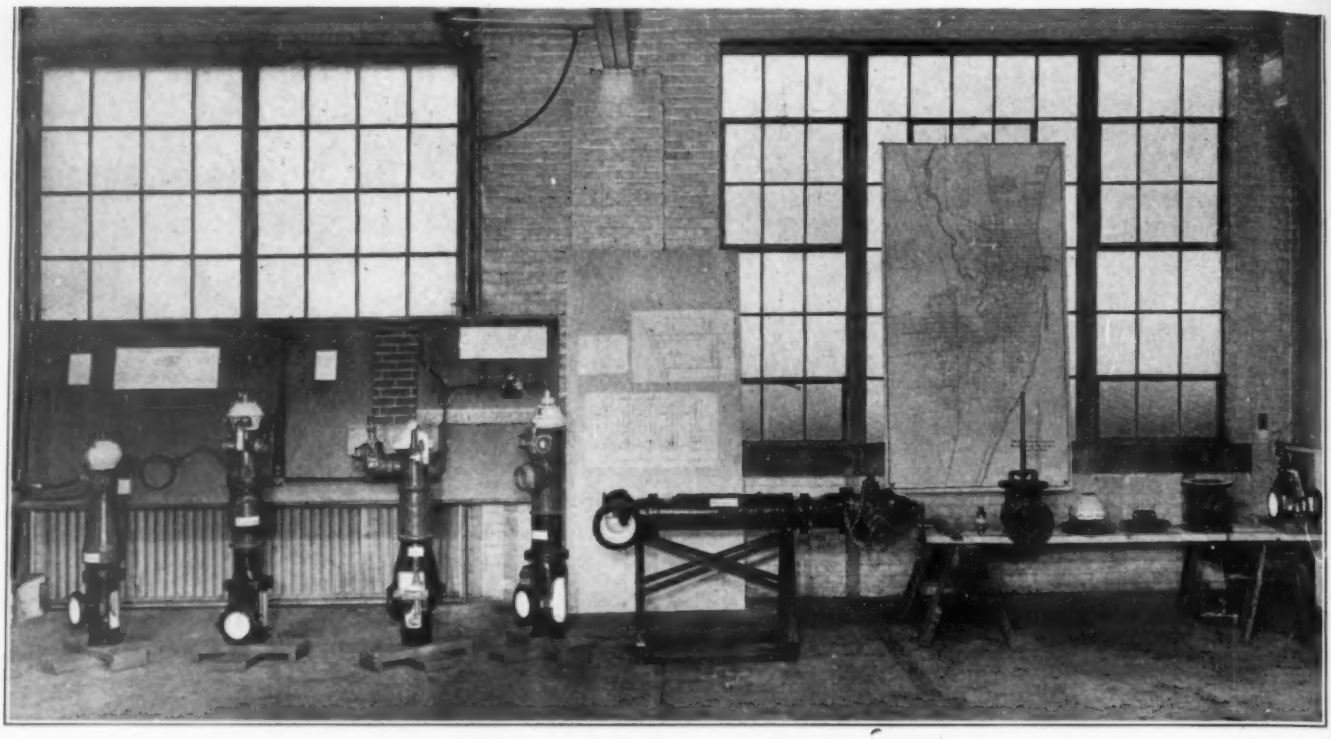
Also serving the National and the water supply industry simultaneously in Washington, A. W. W. A. has had another important member—its President, Abel Wolman, who has been acting as Special Consultant on Water Supply to the Power Branch of the W. P. B. Largely through his efforts was established, during the latter half of 1942, the much alive Water Production Section of W. P. B., headed by Arthur E. Gorman and now staffed with capable water works operators. Going into the industry to secure the key men of the new Water Production Section is evidence in itself of the high regard in which the water works profession is held in the W. P. B.—and the quality of the ambassadorial work of A. W. W. A.'s Wolman, Jordan and associates, in looking after the needs of the industry without losing sight of their duty as the patriots that they are—that all true water works men are when put to a test.

Priorities

The development of priority control and its effect upon the public water supply industry has been of utmost importance during 1942. The restrictions imposed by various Limitation Orders and by Preference Rating Order P-46 have unquestionably caused much paper work and have caused deferment of many desirable water works projects. On the other hand, priority control has meant that water works obtained throughout the year their fair share of the critical materials necessary for the maintenance and operation of their plants and for extensions required in the interest of war production, public health and safety. Priorities have been a plague to many individual water works operators and managers, but have been the protection of the industry as a whole and, in the end, their own protection as well.

Order P-46, originally issued on September 17, 1941,

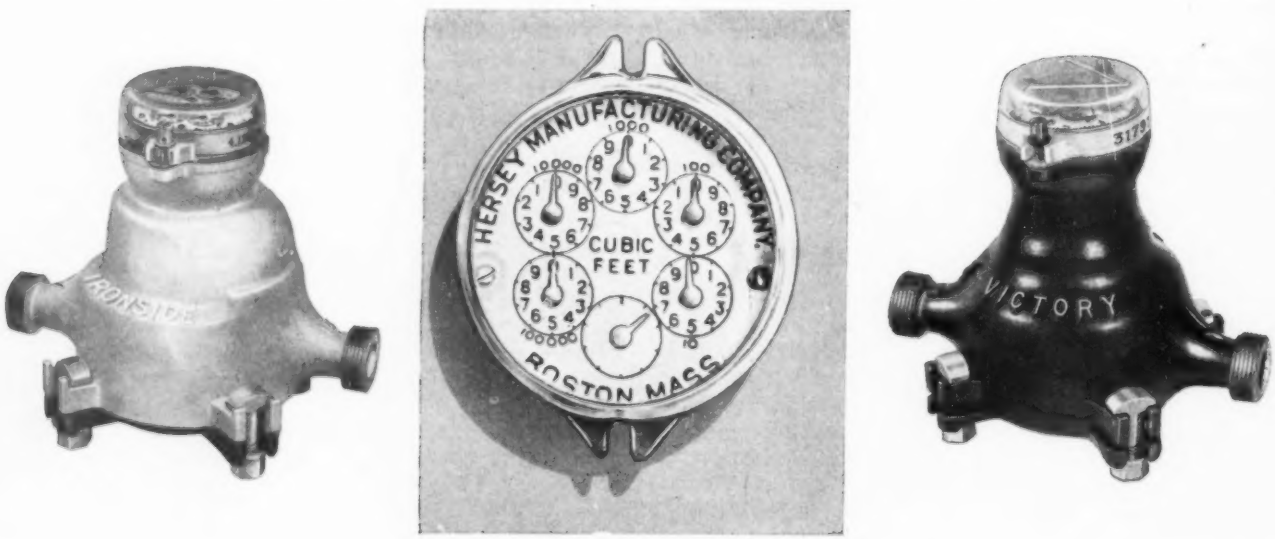
*The author is the new Chairman of the Missouri Valley Section of A. W. W. A.



Example of Training of Water Supply Auxiliaries in the Civilian Defense Program of 1942.
At Racine, Wis., Supt. Walter Peirce used amongst other things a set of cutaway hydrants and valves, meters, service lines, fittings, etc., in his School for New Employees, Fire-fighters and Auxiliaries.

has been amended several times during 1942, each time with tightening restrictions, but all understandable and reasonable in the light of wartime requirements. Compliance has not been difficult where AWWA's slogan—*"Save, Stretch and Share"*—has been accepted. Most difficulties experienced were not caused by priorities regulations themselves, but were due simply to the lack of materials or manufacturing facilities caused by the heavy impact of war on a peacetime economy. While ingenuity and belt tightening have been required to meet these shortages, the water works industry has creditably met the challenge.

At the year's end Order P-46 still required water works utilities to use 1940 operations as a base, with the exception that distribution system maintenance and minor construction were limited to 60 per cent of the 1940 experience. The inventory of distribution materials was likewise limited to 60 per cent of the comparable 1940 inventory, with the further provision that 40 per cent of deliveries of such materials had to come from the stocks of other utilities. Other withdrawals and inventories were restricted to the 1940 dollar basis. Construction of plant additions and main extensions for additional customers were stopped except for short extensions to serve new houses, and other extensions and additions specifically approved by the W. P. B. Quarterly reports of inventory, deliveries and withdrawals were required of the larger utilities throughout the



Three of the Wartime or Victory Meters.
Note the appropriate names of these iron-cased meters and the new clear-vision register boxes of permanent molded glass. Without sacrificing the working parts a 20% reduction in bronze has been realized for the war effort.

year, with the understanding that smaller utilities would be required to submit reports in the near future.

The general reaction of the water works industry has been to accept the priorities restrictions and paper work ungrudgingly, or at least with far fewer complaints than usual. Water works men have realized that, as compared with every other industry, the burdens placed upon them have been light. Except for industrial plants in outright war production, priority ratings given for water works maintenance materials and supplies have been the highest granted any industry. As an example, in December the important chemical industry was still using A-1-a and A-1-c ratings for maintenance materials compared with AA-2x and AA-5 ratings which could be *self-extended* by water works for similar needs. Where the true situation has been understood, water works men have been appreciative of the high priority standing accorded to water works needs by the War Production Board, and have endeavored to cooperate to the fullest extent.

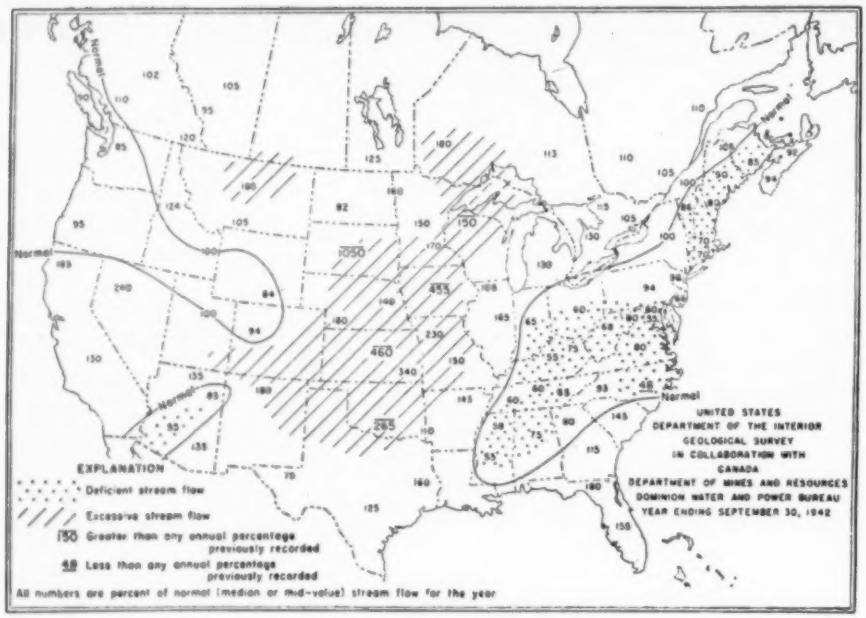
Redistribution

Even before the P-46 requirement that water works obtain a portion of their necessary maintenance materials from other utilities, the movement to share inventories was under way. Surveys and inventory reports revealed that too much "fat" in the form of critical materials existed in the store yards of many water works systems. Many of these items were not purchased as a foresight, but had been accumulated over years. Others were bought with the feeling that peacetime expansion would continue in spite of the war. When it was realized that these inventory items would not be needed for the duration, many utilities listed such materials with their State Mutual Aid Organizations and traded with neighboring utilities. In November the City of St. Louis released several carloads of large pipe to a war plant. In late December several water departments and water companies were advertising that they had pumps, motors, pipe, fittings and valves for sale.

The War Production Board's recognition of water as being one of the most critical resources is evidenced in the fact that the industry has been allowed to continue on self regulated basis with extraordinarily high priority ratings, while other industry has labored under the Production Requirements Plan and the Allocation Classification System. Other industry is scheduled to begin operation under the new Controlled Materials Plan in the second quarter of 1943 and will be completely under this new allocation system by July 1, 1943. Plans have not yet been announced as to the application of CMP to the water works industry. Future regulations will probably depend upon the effectiveness with which individual water works self-police themselves

Toledo Gets Its First Drink of Lake Erie Water in 1942.

Under a former Supt. of Filtration, as Water Commissioner, this handsome new 80 m.g.d. filter plant began supplying Toledo, Ohio, on January 12, 1942, thus ending 72 years of controversy over Lake Erie as the logical source of supply.


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
IN COLLABORATION WITH
CANADA
DEPARTMENT OF MINES AND RESOURCES
DOMINION WATER AND POWER BUREAU
YEAR ENDING SEPTEMBER 30, 1942
EXPLANATION
Deficient stream flow
Excessive stream flow
150 Greater than any annual percentage previously recorded
48 Less than any annual percentage previously recorded
All numbers are percent of normal (median or mid-value) stream flow for the year

The "Water Year" in the U.S.A.
A U. S. Geological Survey Record Map Revealing Runoff Conditions Over the Country in 1942

and to the extent to which they enter into the sharing and redistribution of inventories.

Limitation Orders

Meters: Order L-154, effective June 17, 1942, was issued to conserve as large a percentage as possible of copper, tin and zinc going into water meters, without seriously affecting their life or accuracy. As a result, your favorite meter now appears with a well protected iron case and possibly with a glass or plastic register cover, all with the blessing of the AWWA in the form of an emergency modification of its water meter specifications. All wartime meters are being constructed so that the less corrosion or wear resistant parts can later be replaced by parts which meet the AWWA standards and pre-war specifications.

Copper Pipe: Order M-9-c-4, effective July 22, 1942, was issued to prohibit the use of copper in water and heating systems, except for small amounts necessary for maintenance or replacement of *existing* copper piped installations. Result: water services materials become lead, tube-loy, cast iron, wrought iron, steel, cement asbestos, or cement-lined galvanized steel or wrought iron.

Tar Coating: A September amendment to Order L-42 forbade the further use of tar coatings on cast iron pipe to save over a half million gallons of tar. In this direction San Francisco has developed the use of a thin coat of bituminous enamel applied without primer.

Steel Design: National emergency specifications, effective November 9, 1942, called for the basic unit stress of 24,000 lbs. per sq. in. for all steel design instead of 20,000 lbs. theretofore ordered.

One of the Battery of Flocculating Chambers of the New Toledo Plant
(Equipped with Link-Belt's "Straightline" mechanism).

Civilian Defense and Mutual Aid

With the coming of war came the realization that battles would be fought not only in Europe, Africa, Asia and the South Pacific but also in the war production plants of this country. Without adequate and uninterrupted water supply the war could be lost in our own cities, hence, an early, concentrated effort was made to make certain that sabotage would be prevented and possible bomb damage repaired as quickly as possible. Critical water works plants were fenced, floodlighted and guarded; employes were investigated and finger-printed. Considerable money was spent for this emergency protection with little possibility of retrieving any of it through increased water revenues.

With the organization of Civilian Defense Corps, water works organizations took their proper, though often inconspicuous, part in preparing for the maintenance of vital services under air raid conditions. Cooperative efforts were arranged through the establishment of many joint utility bureaus and local control centers. Statewide Mutual Aid organizations were established in many states to insure quick rehabilitation of services in any bombed city, and to prevent the drain on critical materials and manpower should each community have undertaken to anticipate its own possible requirements. A late development is the report that the War Production Board may establish water works mutual aid plans in areas coinciding with the existing Army Corps areas, as more workable than the voluntary State aid divisions.

Mutual aid has already functioned in several fire and flood disasters. Their proven worth in both wartime and peacetime will cause them to remain as effective units on a permanent basis.

Labor Relations

The continued growth of the labor union movement has brought the question of collective bargaining to municipal as well as private water utilities. The right of self organization of employes has become generally

The New 6 M.G.D. Filter Plant of Newport News, Va.

A speeded up project to serve the important Hampton Roads defense area was started under an A-3 priority and completed Sept. 30, 1942, under the emergency priority of AA-2X to materially relieve the anxiety of Manager Gene Dugger at Newport News.

accepted. Collective bargaining agreements have been entered into with unionized groups of employes by a number of privately owned utilities and also by a few cities. Private utilities have generally had to meet the problem in the same manner as other industrial corporations have done and have had to enter into bargaining agreements where the organized employes desired such agreements.

The question as to whether municipal corporations should or can legally enter into collective bargaining agreements is very much to the fore at the end of 1942. In the East, Newark and New York City are having controversies over collective bargaining. In the West, the Metropolitan Utilities District in Omaha is negotiating with its employes. These disputes came to the attention of the War Labor Board, but in December that agency disclaimed jurisdiction on the grounds that intervention by a Federal agency would transgress upon still valid State's Rights. The W. L. B. did, however, recommend that municipalities recognize the rising status of labor and continue negotiations until fair settlements of the disputes were reached.

Wages

The general rise in wage rates has had considerable effect upon the operation of water supplies. In a number of instances the wages of water works employes have been raised to enable them to meet the higher costs of living, although these increases were usually not enough to prevent a certain amount of emigration of employes to higher paying war industries. In many municipal plants wage increases have not been possible because of charter or other restrictions and valuable employes have left for better paying jobs. Replacements have been difficult to obtain.

The National War Labor Board took jurisdiction over all labor and wage disputes in 1942 and in "Little Steel" decision in July established the yardstick of 15

Akron, Ohio, Boasts This Adequate New Storeyard.

(But, how's your 1943 inventory, Brother La Due?)

per cent over the hourly wage rates prevailing on January 1, 1941, as wages which would preserve the old peacetime standards of living during wartime. This yardstick has been adhered to in a number of subsequent disputed wage increase awards and has been generally followed in a number of wage adjustments to water works employes.

On April 20, by administrative ruling, it was found that private water companies generally came under the provisions of the Wage and Hour Law as an industry affecting interstate commerce, requiring overtime payment to be made on a 40-hour week basis.

As a further wartime emergency, wages and salaries were frozen at the first of October and adjustments therefrom had to receive W. L. B. approval. [The latest information, however, indicates that the W. L. B. does not consider that it has any jurisdiction in the matter of wage adjustments when made by municipally operated utilities.—Ed.]

Restrictions on Water Rate Increases

General commodity price ceilings have been established by the Office of Price Administration in its effort to control the trend toward inflation, and water rates have not been neglected. Procedural Regulation 11, issued by the O. P. A. under authority of the Emergency Price Control Act, Executive Order 9250, and Directive No. 1 of the Director of Economic Stabilization, establishes regulations affecting both municipally and privately owned water utilities. Before water rates may be increased to any class or classes of consumers, it is necessary that notices of proposed rate increases be filed with the Transportation and Public Utilities Division of the O. P. A. thirty days before the effective date of a proposed increase in rates.

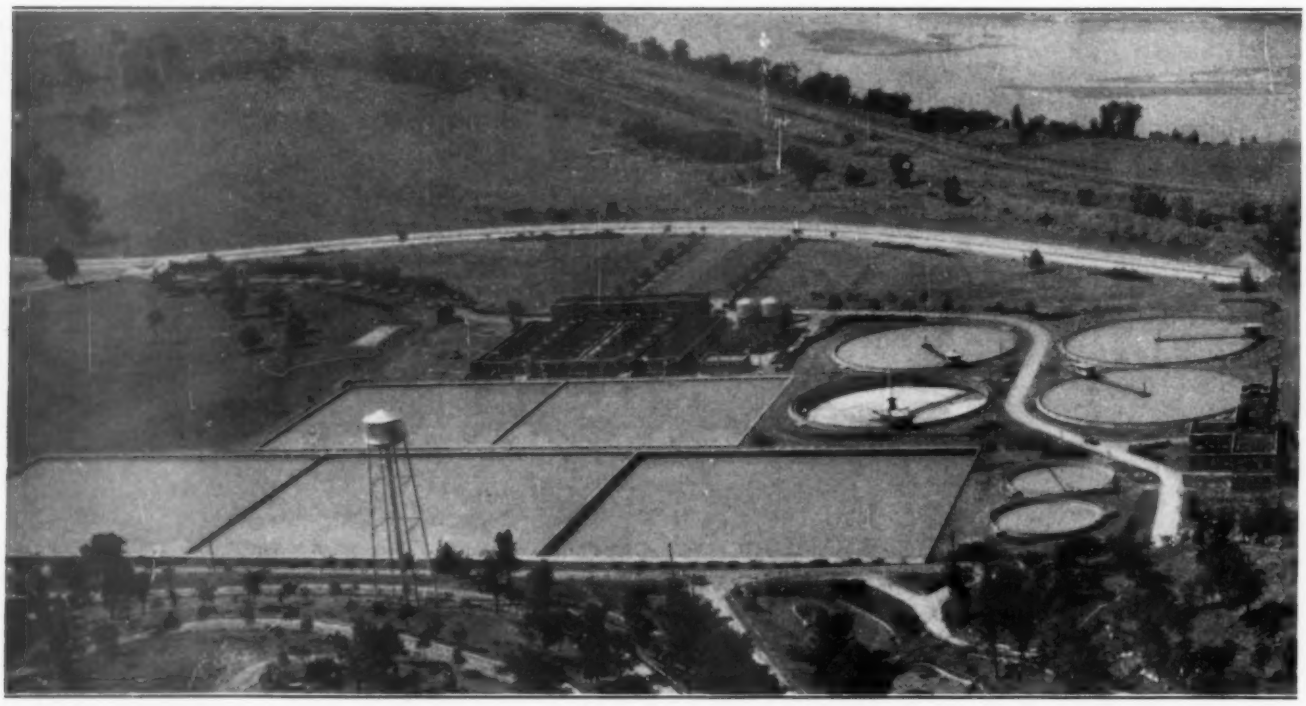
W.P.A. Ends

In December, 1942, the President ordered the Works Progress Administration to wind up its affairs, with February 1, 1943, set as the tentative deadline. The wartime demand for manpower had dwindled the employment by this relief agency from a peak of three and one-third million to less than 400,000 in July, 1942, and approximately 350,000 in December. Thus did war end the existence of an agency which had on one hand accomplished much in the nature of permanent improvements, including more than 16,000 miles of water mains and many water works plants and improvements; but which on the other hand had indulged in practices and projects which would be charitably termed inefficient, wasteful and of doubtful value.

The full import of the costly W. P. A. lesson may never be learned in spite of the fact that it was available to all. Economically speaking, the total cost of most projects was above their value. As a method of making relief payments, the system was no better than an outright dole, since the original principal of giving honest work for pay was usually farcically debased. Instead of being a corrective measure, the psychological unsoundness spread until not only the workers but the sponsors were infected with the idea of "something for nothing." Many normal projects, water works projects included, were withheld until so-called "free labor" was made available, thus denying work to men who had the stamina to relinquish their preferred relief standing. [It is probably out of place in this resume of 1942 developments to step out of character, but the W. P. A. lesson has been paid for, 14 billion dollars worth, and its shortcomings and basic futility should be remembered when future planning is done.—W. Y. W.]

Post-War Planning Begins

Premised on the belief that "no country need be impoverished if its productive resources (both capital and human) are intact," the National Resources Planning Board, together with regional and state planning



Kansas City Gets Softened Water as Reward for Political Housecleaning.

At a cost less than $900,000 *the* 100 *m.g.d. Filter Plant of Kansas City was converted to a Softening Plant of* 150 *m.g.d. capacity. Increase in treatment costs are offset by savings since departmental reorganization. Soft water for nothing for "Kansascitizens."*

agencies, commenced organizing in April. Its objective is stabilization of the post-war economy, with the hope that proper forethought and cooperative effort can prevent the serious economic dislocations which would require new palliative measures similar to the W. P. A. Due to curtailment of Federal funds, the Federal portion of the activities were abandoned late in July, leaving the planning of post-war projects entirely in the hands of local, city and state organizations. These latter organizations, in spite of curtailed manpower, were in many instances functioning creditably by the end of 1942, outlining necessary project plans covering the first several years of post-war construction.

Weather and the "Water Year"

"The water year 1942 was decidedly upside down," to quote from the annual Water Resources Review of the U. S. Geological Survey, "with 350,000 square miles in the eastern states having a runoff of only 69 per cent of normal (sixth driest year in 30 years), whereas the Midwest, 625,000 square miles, had an average runoff of 240 per cent of normal, and for that area as a whole it was the wettest year on record by a very considerable margin."

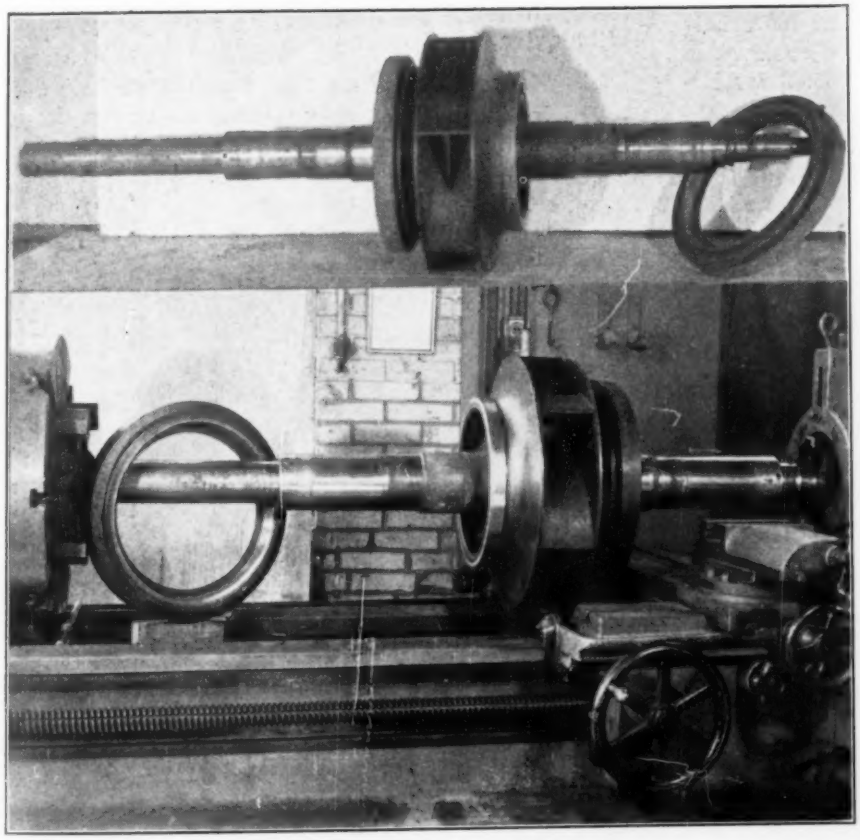
In spite of the continued drouth in the East, which was a continuation of the drouth experienced there in 1941, copious and well timed rains during the late summer and early fall produced normal or higher river stages and caused considerable ground water recharge. Impounded supplies were generally in better condition than at the end of the previous water year, September 30, 1941. Generally favorable ground water conditions prevailed over the United States.

One Manufacturer's Effort

This clarifier mechanism of treated wood and other substitution by Dorr Co. to reduce the use of critical metals is an example of the order of the day.

Thirty-five notable floods were reported for the year. Those in the Central West, from Minnesota to Oklahoma, were the greatest in extent and set record river stages at many places. May floods, covering a belt from Montana to Wisconsin, caused considerable damage. Other floods were generally local, being caused by intensive rainfall over limited areas, mainly in New York, Pennsylvania and New Jersey. The Fredericksburg, Va., water plant was out of service for several days because of an October flash flood.

In the period from October 1 to the end of 1942 generous rains in large part corrected the 1942 deficiency in the East and water storage was about 80 per cent greater than at the beginning of the year. The year went out with a cloudburst, with floods from New York to Missouri.



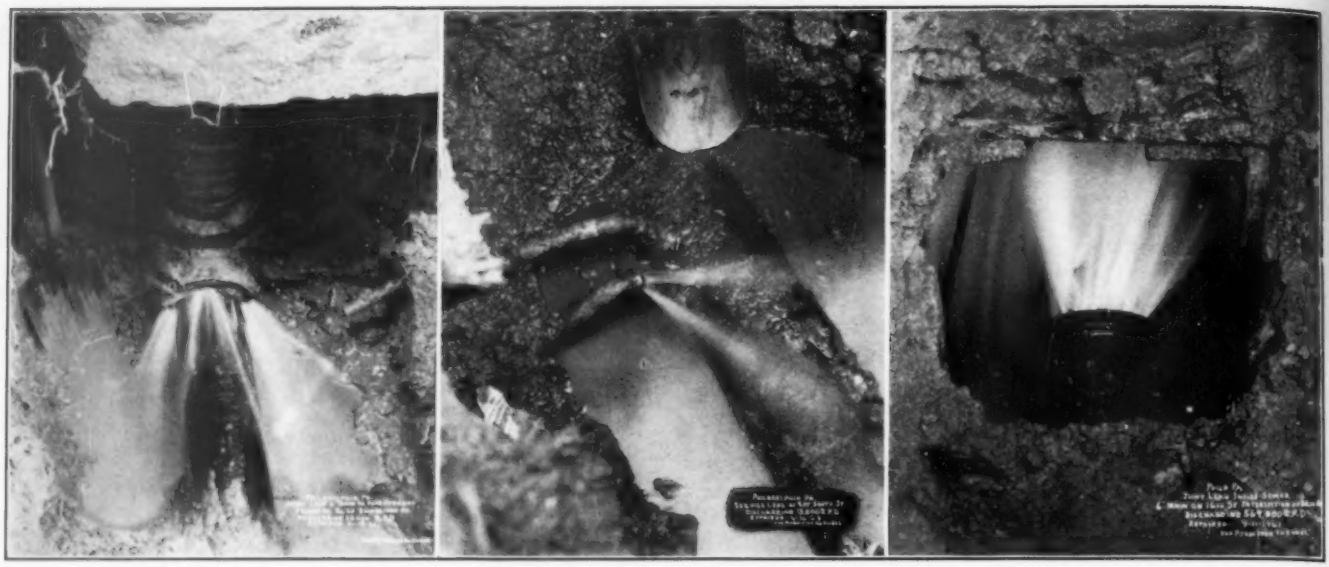
Repair and Maintenance the Order of the Day.

This view of a 20-inch pump rotor of the St. Louis County Water Co. shows the results of restoring sleeves and wearing ring surfaces with the application of bronze or stellite alloy through use of torch and the sprayed on "metallyzing" process which has proved so useful in numerous restoration jobs where metal has worn or pitted away.

Construction Trends

In spite of the rapid elimination of W. P. A. projects from the 1942 construction picture, the dollar value of water works construction contracts increased materially over the 1941 volume. "Engineering News-Record" reported eleven months' construction contracts of water works projects of $15,000 and over amounting to $140,066,000 in 1942 as compared with $74,221,000 in the first eleven months of 1941. Defense projects, which in the latter part of the year were called war production and war housing projects as the war picture changed from defense to offense, caused this considerable increase in water works construction. An outstanding case has been the marked expansion of the system of Newport News, Va.

Realization that the volume of 1942 water works construction contracts approximately doubled the amount of construction contracts undertaken in 1941 and in 1940, and approached the amount of construction undertaken in 1939, ex-



In '43 Philadelphia Did a Real Waste Reduction Job.

In Philadelphia's "Don't Be a Drip" campaign to reduce water-waste and leakage on consumer's premises a Pitometer survey uncovered hidden leaks which together with the educational campaign saved 65 m.g.d. for rapidly expanding war uses; cut down power waste and much wear and tear.

plains the great difficulty experienced in 1942 in obtaining water works construction materials in a market where every other industry was competing for the limited amount of critical materials available.

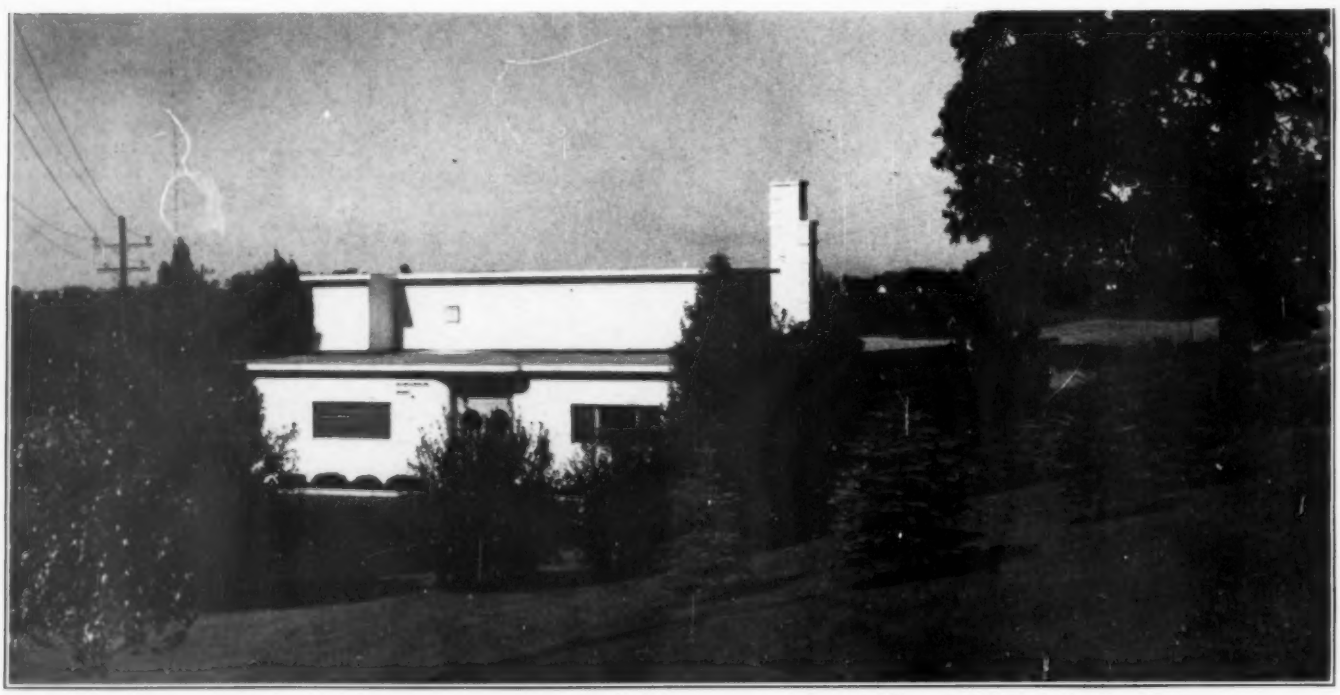
Construction costs continued to rise throughout the year, although the establishment of price ceilings and wage stabilization in the last few months materially checked the rising curve. The E. N. R. Construction Cost Index rose to an all-time high of 283.69 for December, 1942 (1913 = 100), an increase of 6.6 per cent over the December, 1941, Index, and 36.8 per cent above the average 1929 Index.

Major Projects

Construction projects of major size constituting expansion of public water supply systems were confined to localities where war industry or cantonments overloaded existing facilities. Among the cities involved were Chicago, Detroit, Houston, Little Rock, Newport News, Norfolk, Oklahoma City, Tulsa, Philadelphia and Wilmington, N. C.

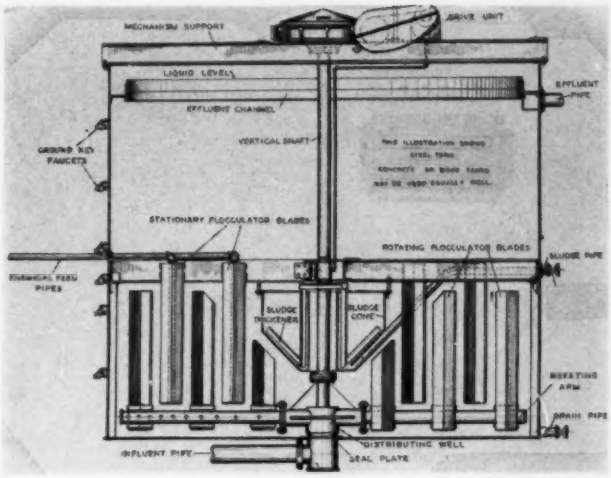
Necessity Was the Mother of:

The impingement of wartime scarcities upon the requirement that water works operations continue to take care of the needs of the communities served caused con-



A Neat Little Filtration Plant Built From Savings at Fergus Falls, Minn.

Also serves as an example of the adaptation of economical architectural concrete construction in an attractive setting, the author's St. Louis County Co. plant being another example.—Ed.



The Dorrco "Hydro-Treator"

Provides flocculation and precipitate contact for speeding reactions, sludge thickening, and up-flow clarification in a single unit.

siderable display of ingenuity. A few of these cases follow:

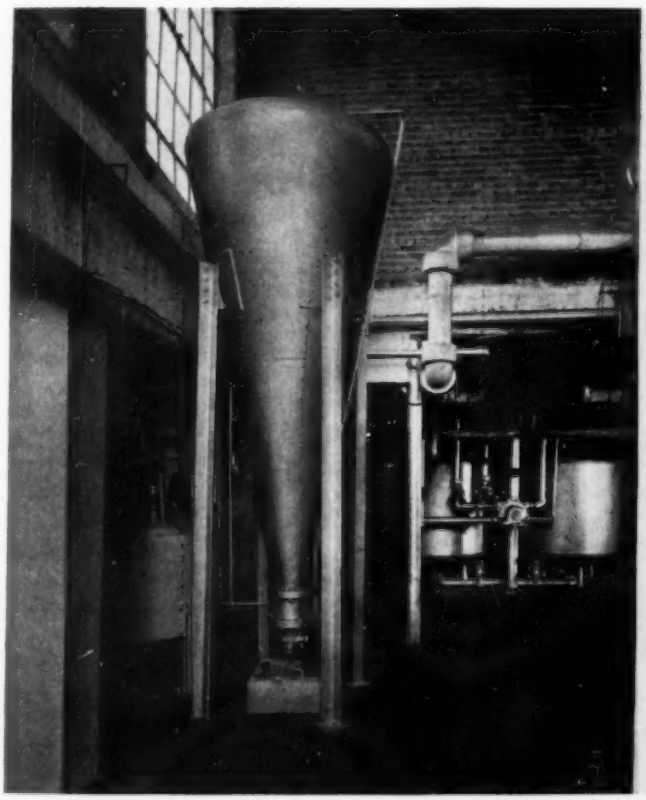
Unable to obtain priorities for cast iron pipe, the City of Savannah, Ga., went to a 23 year old stock of wood stave 6 in. pipe for the necessary materials. San Diego, Calif., was at the same time reconstructing a supply flume of wood, to forego the use of steel where wood would serve in above ground locations.

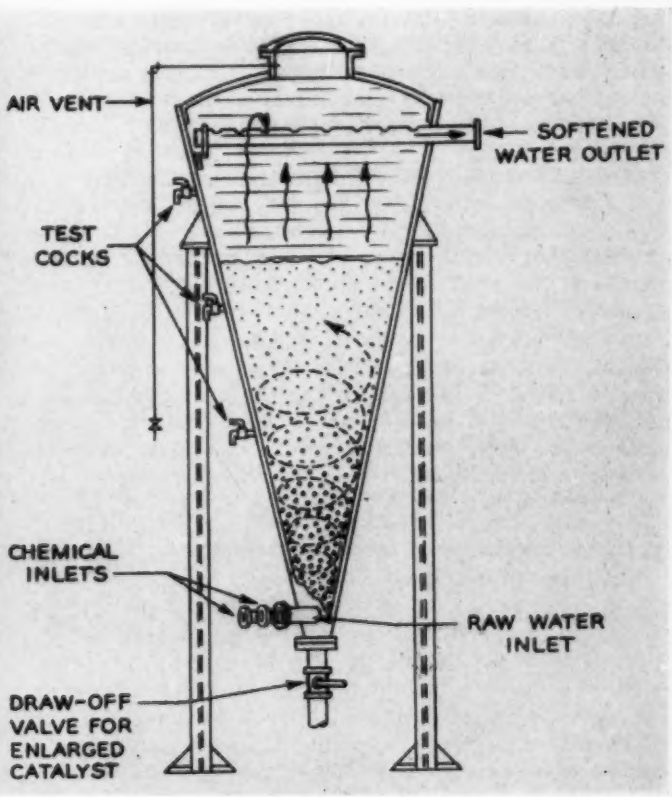
Urgency and a desire to save critical materials caused the Independence (Mo.) Water Co. to apply protective coatings to used 4 in. boiler tubes, welding the sections together to make a serviceable water main.

Red lanterns and flares being taboo in blackouts, San Francisco passed a municipal ordinance providing for reflector button barriers for protection of trenches and paving cuts.

Springfield, Mass., buying "any material of any nature that could be relied upon to carry the city through its period of emergency expansion," purchased used 26 in. steel pipe in St. Louis and 30 in. pipe in Houston. This pipe was cut, rerolled and coated to form 50 and 60 in. pipe.

"Don't be a Drip!" Philadelphia's slogan in a concentrated publicity campaign, caused water wasters to stop leaks, repair faucets and in other ways economize. Through this campaign and a systematic Pitometer





Permutit's "Spiractor"—the Latest Addition to the Family of Up-flow Clorifiers.

In a spiral motion the treated water swirls upward through a suspended "seed" bed of calcium carbonate "sand." A plating-out and agglomeration process removes colloidal carbonates and the most enlarged granules are intermittently ejected through bottom draw-off. Features are speed of completed reactions and small space requirements.

"Flame-Priming"

A 1943 method for instant dehydration of rust and tubercules on steel and iron surfaces to release their grip and permit easy wire brush removal of dust and the few tubercules that fail to fall away in the flaming operation. The method is not without its points.

Leak Survey, an estimated 65 m.g.d. was saved for expanding war uses.

With deliveries of large gasoline engines months away, the St. Louis County Water Co. adapted a 12 cylinder, 473 cu. in. Packard auto engine to drive a 12 in. peak load booster pump. Similarly, needing a larger engine, the Lexington (Mo.) Water Co. obtained a 16 cylinder Marmon engine for standby duty.

Lacking 10,000 ft. of 36 in. pipe to complete an emergency diversion line, Norfolk, Va., borrowed inner steel cylinders not yet used in concrete pipe and jointed them above ground for temporary use.

Through critical material substitution The Dorr Co. was able to show a saving of 5,000 lbs. of steel out of an 8,000 lb. total weight on one machine alone! Because of steel shortage they are also using wood structural members for walkways, handrails, cross braces and paddles wherever possible.

The traffic with junk yards became a two-way proposition. With large quantities of scrap being sold by water works to help augment the badly needed supplies of scrap for steel making, there were still many occasions when water works operators had to go to junk yards for salvaged materials since new materials could not be obtained.

Processes and Equipment

With all possible effort being bent to the idea that first things come first, and the prosecution of the war being the first job for all, new developments in the water supply industry were possibly not up to normal during the year and will certainly be overshadowed in future years when efforts are turned back into normal channels. Deserving comment, however, are several notable developments of processes and equipment:

Ion Exchange Purification

Processed water with distilled water characteristics is attracting wide attention in the field of industrial water treatment and may later be adaptable in the field of public water supply. In the first step of the process a carbonaceous zeolite is employed to exchange calcium, magnesium and sodium for hydrogen. In the second step the carbon dioxide formed is dispelled by aeration and where mineral acids are formed during the first treatment, these are removed by absorption, leaving a nearly neutral water with very low dissolved solids. Regeneration of the carbonaceous zeolite is accomplished with an acid rinse. Regeneration of the resinous acid absorption material (second stage) is done with a sodium alkali rinse. Processed "distilled" water, thus produced, is being utilized for metal washing in certain war plants; in the textile industry for bleaching, washing and dyeing; in manufacturing plants where nearly pure water is an important constituent of the manufactured product; in storage batteries and in high pressure boilers.

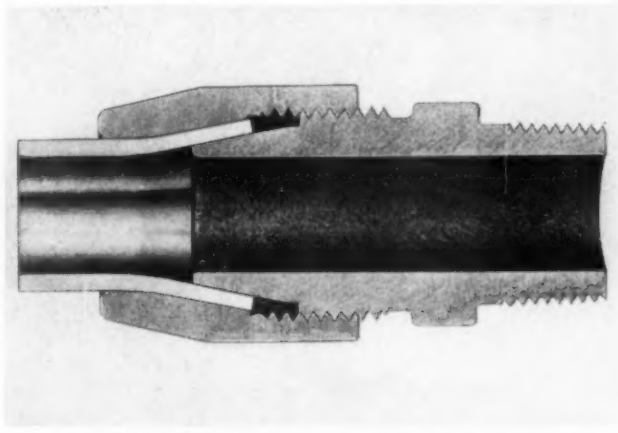
Softeners and Clarifiers

Added to the family of upward flow, sludge blanket contact softening and clarification units ("Precipitator," Permutit; "Accelator," Infilco; "Hydrotreator," Dorr; "Reactivator," Graver) is the "Flocsettler" manufactured by American Well Works. While these plants, when used for softening, act to some degree as crystallizers in the removal of calcium and magnesium carbonates, Permutit offers the "Spiractor" as a catalytic precipitation or crystallization device and has an initial minimized plant installed at Teutopolis, Ill. (reported Engineering News-Record, September 24, 1942). Water is passed upward through a "seed" bed of calcium carbonate catalyst granules in a conical tank. Precipitated carbonates "plate out" or agglomerate on the seed nuclei. As the granules enlarge they are drawn off at the bottom of the tank and fresh catalyst is added as makeup.

Pipe and Tubing of Plastics

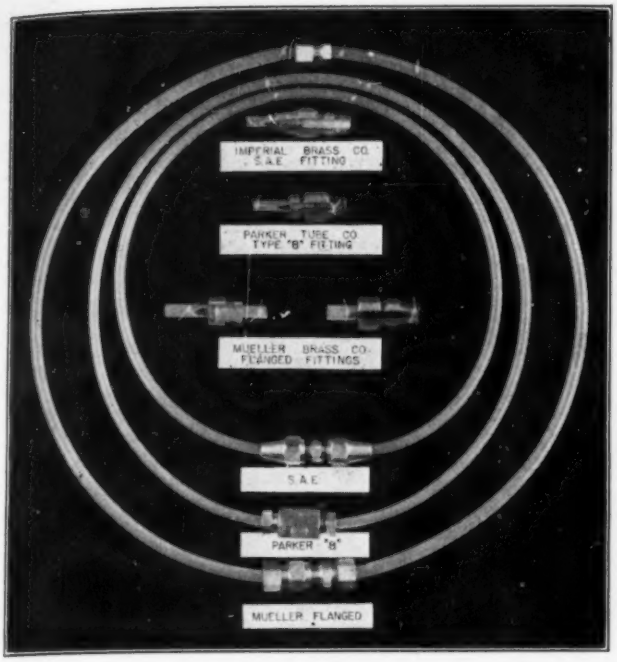
Plastics are coming of age. Although it may be a few years before plastics are seriously considered for water mains and service pipes, some already developed are suitable for conveying chemical solutions in water treatment plants, not necessarily as substitutes for but as improvements upon existing materials. Available now but in some instances as hard to get as rubber are:

"Saran," made by Dow Chemical Co., is reported satisfactory for nearly all water works chemicals, including ferric sulfate and ferric chloride, but not chlo-



Special Flared Fittings for "Tube-loy" Tubing.

1943 saw the special "Superseal" fitting developed by Grinnell Co. for the alloyed lead "Tube-loy" which bids fair to broaden the use of this service line material introduced in **1941.**



"Saran" Plastic Tubing and Bronze or Brass Fittings

A Dow Co. product made available as flexible tubing in sizes ⅛ to ¾ inch and as pipe in sizes ½ to 2 inch. The tubing is jointed with ordinary flare type fittings; the pipe with screwed on flanged joints.

rine or ammonia. It may be obtained in sizes ⅛ to ¾ inch with varying wall thicknesses as flexible tubing, or in i.p. sizes ½ to 2 in. Flare type fittings for tubing and screw and flanged fittings for pipe are available.

"Nitron," made by Monsanto Chemical Co., appears to have good resistance against chlorine solutions. A test specimen placed in a chlorinator bowl showed no deterioration after several months.

"Tenite II," made by the Tennessee Eastman Corp., was found to be resistant to weak chlorine solutions but softened when exposed to strong, moist, gaseous chlorine.

"Tygon," made by U. S. Stoneware Co., is reported to be resistant to most of the water works chemicals including chlorine, and may be obtained as flexible or rigid tubing. A moulded fitting is available.

"Lucite," made by Du Pont, has been found resistant in several applications to ammonium sulfate solution and is available as rigid tubing.

Joint Materials

With sea transportation disrupted by war, jute became one of the scarce materials. To take its place, Hydraulic Development Corp. offered "Fibrex," made of water repellent paper fiber. Cost is stated to be about 30 per cent less per joint than jute and, unlike jute, it will not breed bacteria. It has been favorably received by a number of water utility foremen who have tried it.

Still available is the rubber packing developed by Hayes, Kuhns, but in an additional ring form, jointed by a short wire insert. Of reclaimed rubber. It is only available on priority jobs, however.

"Fibrex"

This 1943 jointing material, introduced by Hydraulic Development Co., seems to have many advantages. Made of tough water repellant paper, is sterile when received and affords no comfort to bacteria desirous of propagation in pipe line joints; appears to be an economical and practical answer to the jute problem.

Flame-Priming

A very practical method for preparing old metal surfaces for protective coatings has been developed in the use of an oxyacetylene flame for dehydrating hydrous iron oxide coating, allowing the flame blast to dislodge rust, tubercules and scale. A wide head attached to a welding torch body allows the intensely hot flame to do a quick dehydrating job. Proper speed of the heating operation causes a greater expansion of the rust and scale as compared with the base metal, causing the foreign matter to literally pop off the surface of the pipe, tank, or other object being cleaned. The surface is left clean, dry and warm, allowing the protective coating to go on faster and tighter. The method has been found to be an excellent substitute for the sand blasted surface by more than water works during the year. Atlanta has found it highly satisfactory in rehabilitating steel pressure filter tanks.

"Tube-loy" Pipe

The use of Tube-loy pipe, available for service pipe since 1941, has been broadened by the development of the Grinnell "Superseal" flared fittings. These fittings are corrosion protected iron and afford a long tapered flare contact with the comparatively soft pipe, correcting trouble encountered when earlier attempts were made to use copper tubing fittings with the alloyed lead "Tube-loy" pipe.

Mechanical Joint Water Main Fittings

A very complete selection of mechanical type repair fittings has been developed to afford quick repair of damaged water mains. Developed in anticipation of wartime emergencies, these repair fittings have proven adaptable for ordinary repairs, since the slight increase in cost over poured joint fittings is more than compensated for by lower labor cost and quicker resumption of service. These fittings may be obtained from Dresser and Skinner, coupling manufacturers, and the suppliers of cast iron pipe.

Butterfly Valves

Easily operated butterfly valves having low pressure loss characteristics were offered in 1942 by the R-S products Corp. Inherently balanced in design and economical in cost, they are available for manual or remote control operation.

Improvements and new 1942 models in portable units for feeding hypochlorite solutions were offered by chlorinator manufacturers.

Miscellany

Deserving more than passing mention are the series of virile lithographs by Rockwell Kent which appeared as ads of the U. S. Pipe & Foundry Co.

By rejecting the only bid received for the construction of the Bluff Creek dam and Diversion Canal and doing the work force account, the officials of Oklahoma City now find

themselves with enough money left to build their filter and pumping plant.

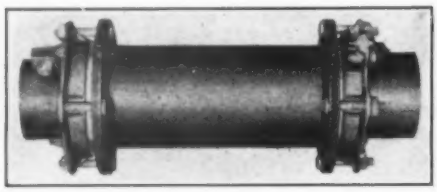
The new storage tank at Jonesboro, Ark., seems to have something that a regulation elevated tank does not have. Being the combination of a 33 ft. diameter by 70 ft. high standpipe surmounted by a 35 ft. deep spheroidal tank, it is not only eye-appealing but will still be effective if and when pressures get down to the point where water no longer exists or can no longer be kept in the upper tank section.

The AWWA Committee on Control of Chlorination and other researchers on methods for accurately determining residual chlorine have uncovered a great deal of new information and have also corrected previous misinformation during the year. Of especial interest are the papers appearing in the November, 1942, issue of WATER WORKS AND SEWERAGE and the December Journal of the AWWA.

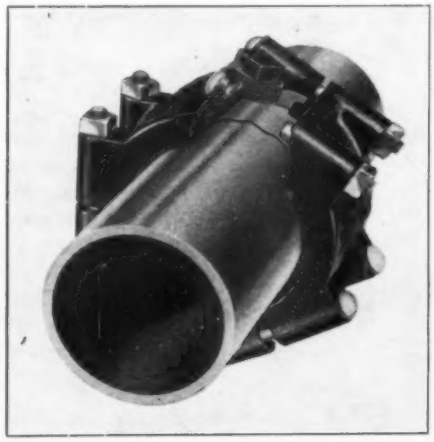
Noteworthy Were U. S. Pipe's 1943 Ads. *One of U. S. Pipe and Foundry Co.'s 1943 series of plates lithographed on stone by Rockwell Kent.*

Further and convincing evidence reported in WATER WORKS AND SEWERAGE (September, 1942) has come out of the Armco Research Laboratories to the effect that certain forms of corrosion and red or black water troubles are subject to control by chlorination and the maintenance of residual chlorine to inhibit biological corrosion and suppress crenothrix growths which can be responsible for many consumer complaints and chokage of piping systems.

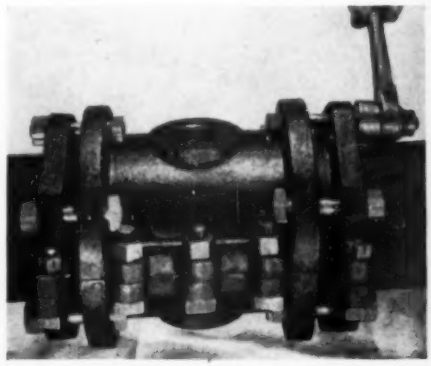
Water works alum has suffered due to the war demand for aluminum. The change in quality due to the use of native bauxite is seen when the Emergency Alternate Specifications issued by the AWWA are compared with the standard specifications.



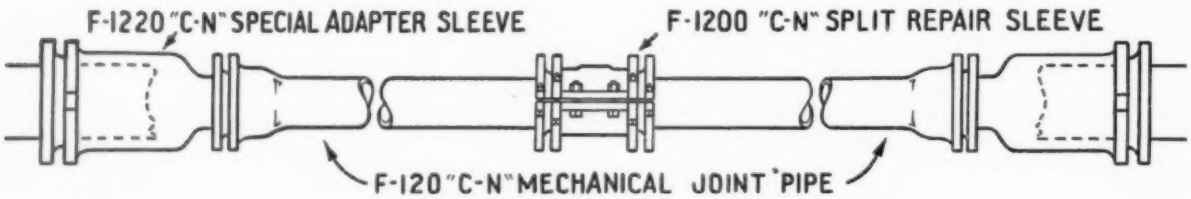
Skinner's Emergency Clamps and Make-up Tube.



Dresser's Three Part Adjustable Repair Sleeve.



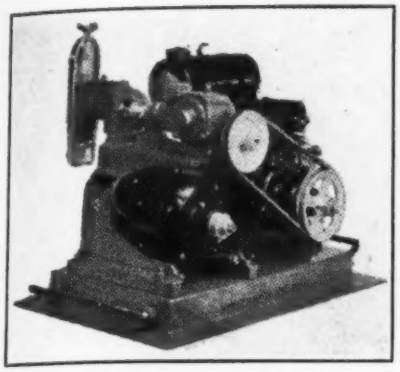
ACIPCO'S Simplex Rubber Gasketed Split Repair Sleeve.



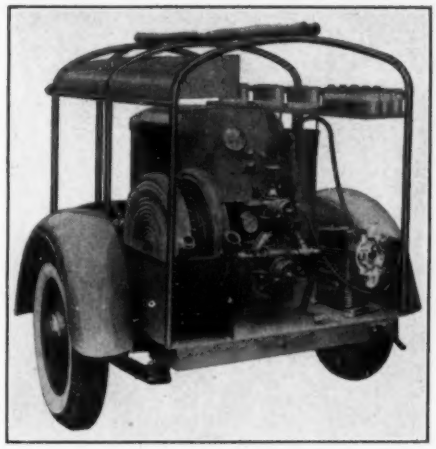
Clow-National's Combination of Split Repair Sleeve and Adaptor Sleeves Developed to Serve in Any Pipe Rupture Eventuality.

"War Babies"

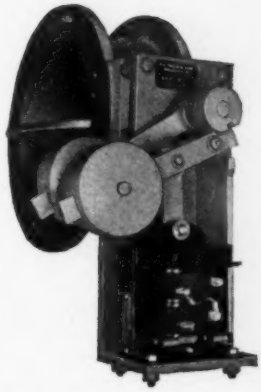
New in 1943



Wilson's Portable Chlorinator.



Proportioner's Mobile Treatment Unit.



R-S Product's Solenoid Butterfly Valve.

	Standard Specification Per Cent	Emergency Specification Per Cent
Water soluble alumina, not less than	17.0	14.0
Iron, not more than.....	0.75	3.0
Insoluble, not more than.....	7.5	15.0

Looking Forward

It is difficult to forecast developments for 1943. On a realistic basis, the situation in respect to materials and supplies will probably get worse before it gets better. Much confusion is behind us; the water works operator's position has been well defined; the need to *"Save, Stretch and Share"* has been brought home to all excepting a few die-hards. 1943 will be a year requiring the exercise of as much or more ingenuity than developed in 1942. But in 1943 the water works industry will "carry the ball," just as it has always done in the past.

An Acknowledgment—WATER WORKS AND SEWERAGE feels highly grateful to Mr. Weir for his speedy work in producing this splendid and most readable review. His aid was sought on short notice, when Dean Sam Morris of Leland Stanford, who had the review job under way, was called upon to do a MUST job for the U. S. Navy in December and wired in his inability to have the review in time for this issue. An S.O.S. to "Vic" Weir that he "take over" was met with the gratifying response and the result herewith, which is truly a remarkable pressure job. If any reader feels that some item of importance has been missed, let him consider the pressure under which the reviewer was working to cover the field and meet a "deadline" on less than a twenty-day notice, including Christmas week.—L. H. E.

"Utilitarian Beauty"

Once more exemplified in the attractive 1,000,000 *gal. elevated tank of Jonesboro, Ark., to which its under standpipe adds stability of structure, improved appearance, plus a* 500,000 *gal. emergency reserve of supply. No less do Jonesborans admire their new tank than the insurance rate cut which came in with it.*

HOW METERING SAVED A MAJOR CAPITAL EXPENDITURE

Experiences and Results at Warsaw, N. Y.

By GERALD F. SHEEHE
Superintendent of Public Works
WARSAW, NEW YORK

THE information in this article is designed to aid those communities whose water services are not metered and who are desirous of obtaining accurate data as to the results which may be obtained from effective metering. It is not to be construed, however, that every community will obtain results identical to those at Warsaw, but it is hoped that the material contained herein may be of value to you should you be faced with a problem similar to ours.

For purposes of comparison in anticipating results, let me describe briefly our water system.

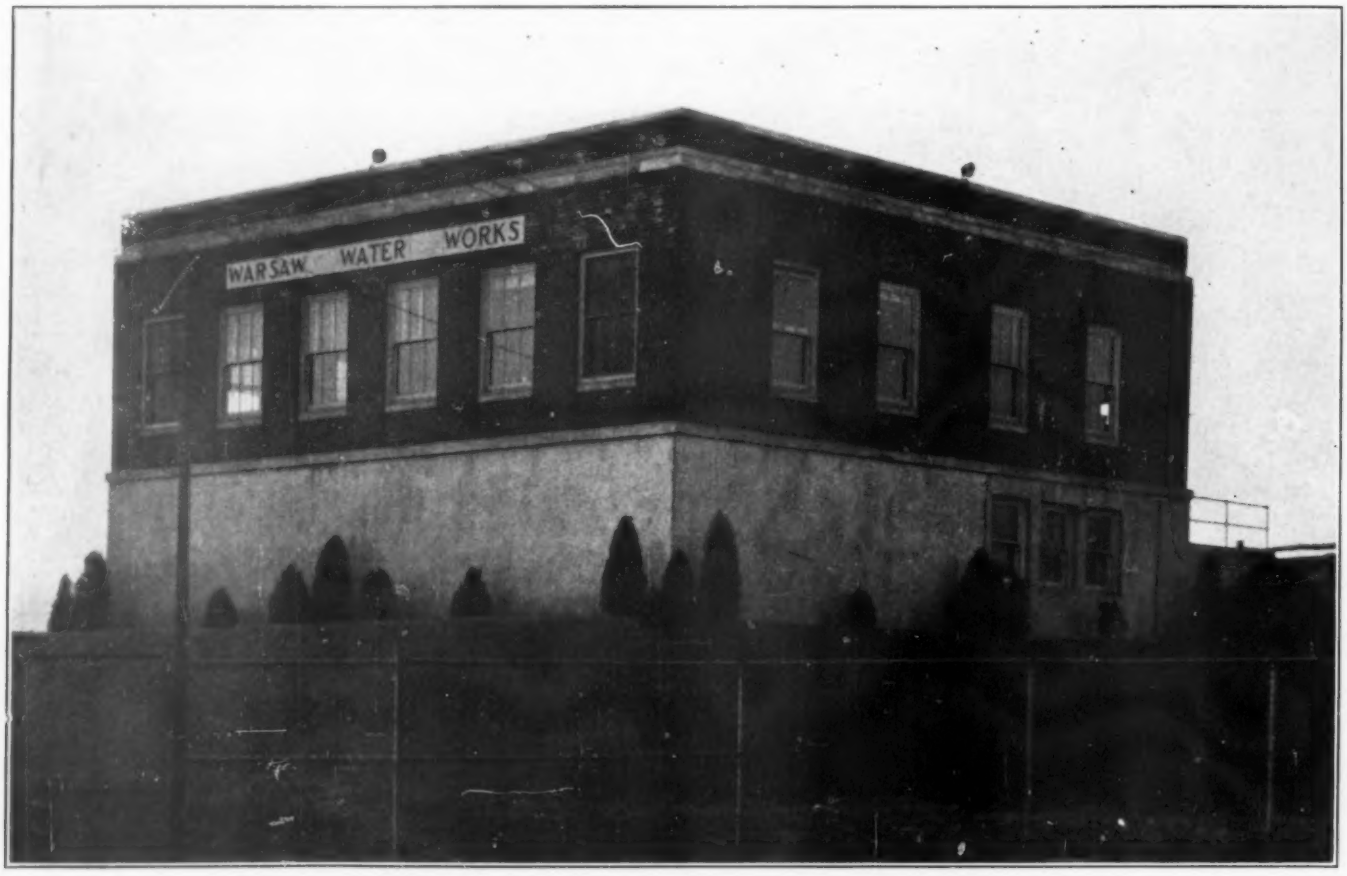
The Warsaw System

Ours is a small Western New York village with a population of 3,600. The water distribution system is of the grid type and was installed in 1897. All mains are of cast iron, bell and spigot type, joints caulked with lead, and size ranges from four to twelve inch. The system contains approximately twenty-eight and one-quarter (28.25) miles of mains, one hundred thirty-seven (137) hydrants and one hundred sixty-eight (168) valves. Our storage reservoir of thirteen and one-half million gallons is located four miles south of the village and at an elevation three hundred and twenty feet above the center of our system. This gives us a static pressure of approximately one hundred thirty-eight pounds, which is desirable for fire fighting purposes but conducive to a high rate of water leakage, particularly in household fixtures.

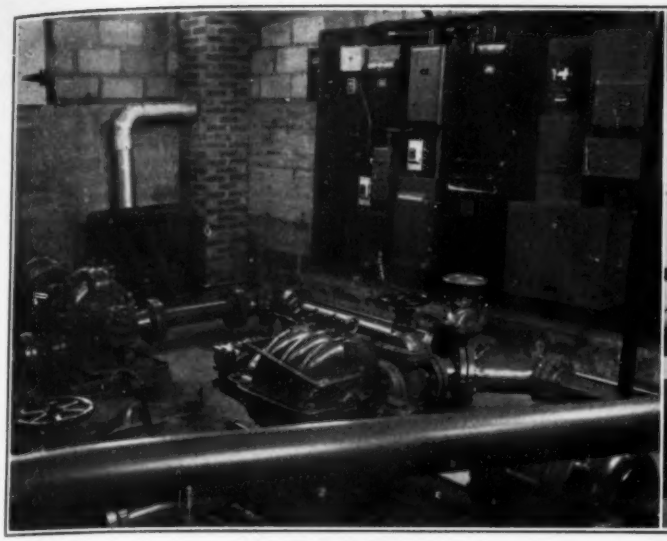
The Author

The Problem

Our problem developed, not from a shortage of water, but from an improvement to the system, namely, a rapid-sand Filtration Plant completed in May, 1939. This plant was designed on the basis of one hundred gallons per capita per day, with a safety factor of nearly eighty per cent. In other words, we had a plant with a normal capacity of sixty hundred fifty thousand gallons per day for a community of thirty-six hundred population. Upon putting the plant into operation it was discov-



A Filter Plant That Metering "Stretched"—Warsaw, N. Y.



Pumping Station
High and Low Service Pumps and Control Panel.

Filter Operating Floor
Two filters, 225 gpm. each effluent and wash water meters; Laboratory (left) and Chlorinator Room.

ered that our demand far exceeded normal plant capacity. In fact, for the first full year of operation our total consumption averaged eight hundred, thirty-eight thousand, eight hundred thirty (838,830) gallons per day, with the month of August, 1939, averaging one million, one hundred thousand (1,100,000) gallons per day. It became evident that something drastic would have to be done to correct this condition. There were only two solutions: either the plant capacity would have to be greatly increased or the consumption would have to be reduced.

The Correctives

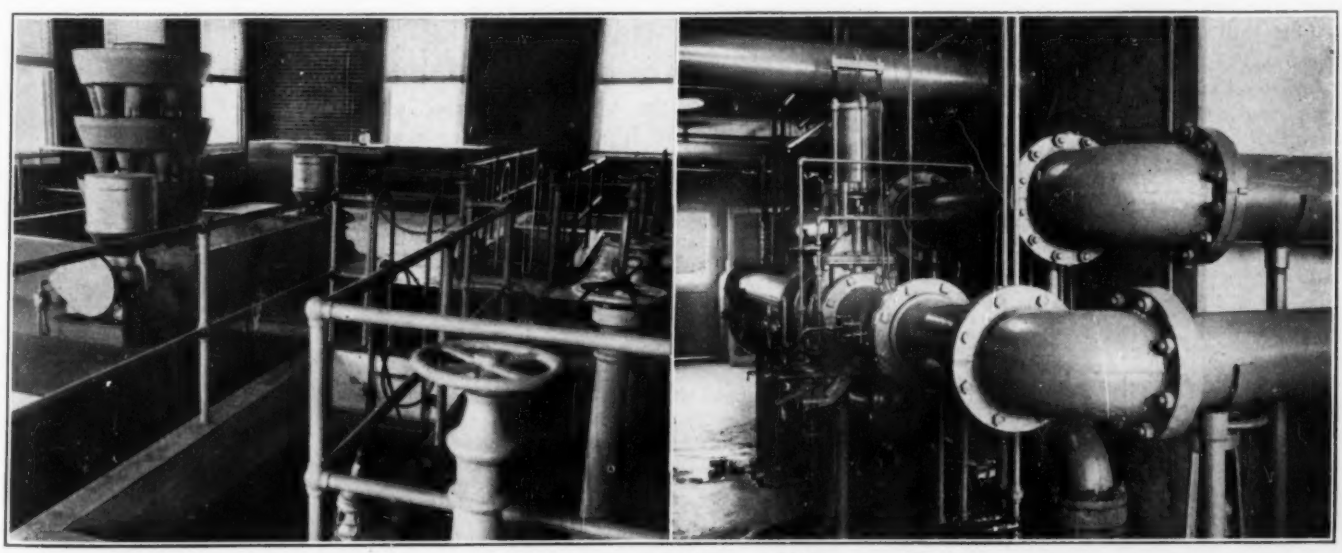
We approached this problem by taking the lesser of two evils, namely, attempting to lower the consumption, which we felt was excessive. During the Fall of 1939 and Spring of 1940 a house to house inspection of all fixtures was made. Where leaky fixtures were encountered, orders were given to have them repaired. Ten days later a follow up call was made to see if orders had been carried out. Where no leaks were encountered, suggestions were made as to how water might be conserved. During this same period we checked our own system and found very few leaks. This method was only partially successful so it became necessary to look for another solution.

During the Summer and Fall of 1940 a thorough survey of surrounding communities, whose water services were metered was made, with particular studies of their domestic rate of consumption, industrial rate, and the rate at which the water was billed to the consumer. As a result of our studies we concluded that our excessive rate of consumption was due primarily to household waste and that by metering the village 100 per cent we could bring that consumption well within the capacity of our plant.

Taxpayers Approve Metering

The proposition of metering was placed before the taxpayers and the Village Board received permission to purchase the necessary meters. Customary quotations were received and the low bid of the Buffalo Meter Co. was accepted.

The work of installation began in April, 1941, and was completed January 1, 1942. Seventy-five per cent were in place as of July 1, 1941, and those properties were placed on a metered rate as of that date. The balance were placed on a metered rate as soon as each installation was completed.



Aerator Room and Pipe Gallery.
The aerator is the three tray multi-coned unit on left. Chemical feeders on right and left.

Method Followed

It might be interesting at this point to describe the method of installation. A pickup truck was equipped with the necessary pipe, fittings, dies, vices, etc., to supply three plumbers. One of the regular village force acted as checker and helper. He recorded material and labor on each meter installed, meter number, location in building and any other pertinent information. The boss plumber and I preceded the crew and decided upon meter location and manner of installation. The entire crew then proceeded along a street, completing all installations except those which would require too much time. After all of the regular installations were completed, two of the plumbers were released and the one plumber and our helper finished the program.

The total cost of this work to the village was $13,779.24, which breaks down as follows:

Meters	$12,031.07
Test equipment	211.00
Installation	1,537.17
	$13,779.24

There were 1,200 meters installed and the average cost for installation was $1.28 per unit.

Results and Effects

Now that the metering program was completed, the question was—were we going to get the reduction in consumption that we anticipated? Here are the actual figures taken from a daily chart started in 1939 and maintained to the present:

Conditions	Periods	Average Consumption
System unmetered	June, 1939, to June, 1940	838,830 Per Day
System unmetered	June, 1940, to June, 1941	666,014 Per Day
Eleven months metered	June, 1941, to June, 1942	464,809 Per Day

To show you that the trend is still in a downward direction:

Periods	Average Consumption Per Day
June through October, 1941	487,016
June through October, 1942	463,106

It is evident from the above figures that we have now successfully solved our problem. Our Filter Plant is now operating well within its normal capacity and we have no thoughts of increasing its size. While a sum of close to $14,000 was expended, a saving to the taxpayers was realized in the following ways:

1. Were the plant increased in size sufficient to cover peak demand, an expenditure of $50,000 would have been necessary.

2. With a larger plant maintenance, taxes, interest on bonds would have been proportionately higher.

3. If we assume that the average consumption was still 666,000 gpd. as against 464,000 gpd., we have a saving (figured at a minimum of 10 cts. per 1,000) of $7,373 per year.

Other Factors

Further than an actual money saving, there are other factors which should be considered. First, there is only one fair way, both to the consumer and the producer, to market water, and that is through a meter. Secondly, a Water Superintendent can keep an accurate check on line losses by balancing consumption against plant effluent, which can be accomplished in no other way than through complete metering.

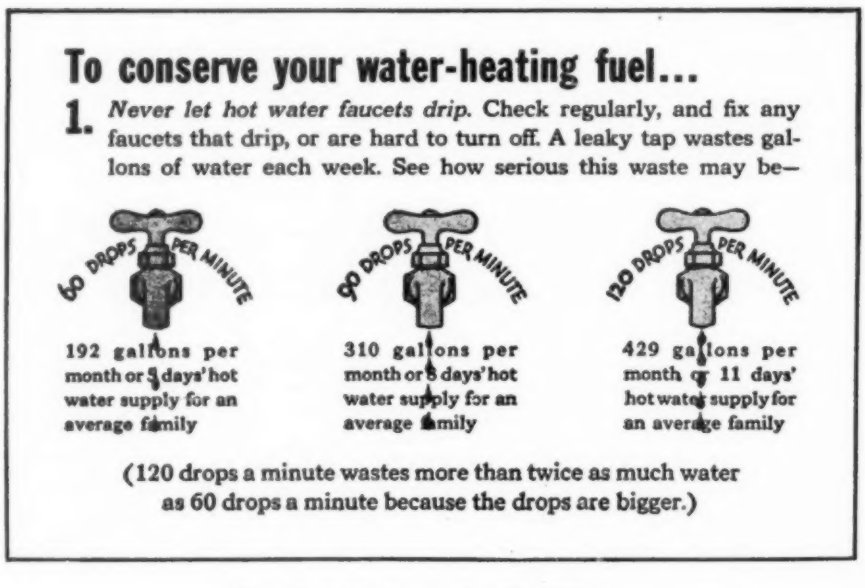
From the results which we obtained here in Warsaw, N. Y., I would strongly recommend to any community the installation of meters. And, while there will, no doubt, be opposition and difficulties encountered, the results will be well worth whatever you may have to go through. I hope that our experiences may help you over the rough spots.

Gas Companies Helping Make Consumers Leak Conscious

In the New York Metropolitan Area, as probably elsewhere also, the gas company is circularizing its customers with pamphlets bearing the caption, "Fuel Savers." In addition to telling the many procedures which will make for fuel conservation through heat-proofing the home, the rear cover of the leaflet prominently displays the above illustration of how fuel may be wasted by way of dripping hot water faucets.

While preaching precious fuel saving, this illustration and the page of text devoted to hot water conservation will probably prove many times more effective in bringing about water waste reduction than anything that the water utility might put out, unless it might be the effective Philadelphia slogan, *"Don't Be a Drip!"*

Out of this comes a "thought for the day." Perhaps if water utilities added this fuel and heat waste approach to their other educational efforts to reduce consumer waste of water it might prove the argument that wins—the point being that if the consumer becomes hot water leak conscious he will more than probably automatically become cold water leak conscious also.


To conserve your water-heating fuel...
1. Never let hot water faucets drip. Check regularly, and fix any faucets that drip, or are hard to turn off. A leaky tap wastes gallons of water each week. See how serious this waste may be—
60 DROPS PER MINUTE
192 gallons per month or 5 days' hot water supply for an average family
90 DROPS PER MINUTE
310 gallons per month or 8 days' hot water supply for an average family
120 DROPS PER MINUTE
429 gallons per month or 11 days' hot water supply for an average family
(120 drops a minute wastes more than twice as much water as 60 drops a minute because the drops are bigger.)

Save Fuel by Conserving Hot Water

N. C. SECTION'S WARTIME CONFERENCE AT DURHAM

Reveals a Rejuvenated Section, Again Going Places and Doing Things. Registered Attendance 198.

FOR the third time in the history of the North Carolina Section of A. W. W. A. and the N. C. Service Works Association, Durham, N. C., served as host-city for

Retiring Chairman
D. M. Williams, Supt., Water & Sewage, Durham, N. C.

New Chairman
W. H. Hall, Dean, Duke Univ., Durham, N. C.

the joint annual meeting of these interlocked associations.

The proceedings of the 22nd Annual Meeting revealed that North Carolina is again out ahead on the "Water Front" and that North Carolina operators are out to see this war quickly won—whatever it may take. And especially noteworthy is the splendid job done by North Carolina's Water Coordinator—Warren H. Booker, Chief Engineer, N. C., State Dept. of Health—in the line of getting together inventory records of water works in the State, from which has developed a Master Inventory, and performing generally useful services in behalf of operators and the war effort as a whole. It was also stimulating to hear the name of this same leader read out as the winner of the long established award to that member of the N. C. Section responsible for securing the greatest number of new members during the year.

Booker Cup Winner

To Warren H. Booker, then, went the third M'Kean Moffitt Cup for it has now been replaced twice by the donor, whose name the cup bears, because it has been won for a third time by the same new member getter twice in past years. So Mr. Booker's name goes at the top of Moffitt Cup No. 3.

An Old-Timer Returns

And it seemed with an older N. C. Section that made A. W. W. A. history in earlier years when the oratorical voice of Wilmington's "Rebel"—M'Kean Moffitt, Supt. of Water and Sewerage in this coastal city—rang through the hall when he presented the cup, the establishment of which did much to build a larger Section, and again echoed as he strode back and forth in the technical session where he was scheduled to unravel "A Certain Superintendent's Nightmare," in a certain balmy and once peaceful sea-side city of that state, once referred to by a famous tarheel as "Only a valley of humiliation between two mountains of conceit." Yes, a "nightmare" that began as just an upsetting dream, when war activity first began in his city and contiguous area and ran up with the passing of time to the crescendo of a real nightmare when "Hell broke loose in Pearl Harbor."

We regret that we can not reproduce M'Kean Moffitt's especially

Cup Winner and Donor

W. H. Booker, Chief Engineer, N. C. State Dept. of Health*

M'Kean Moffitt, Supt. of Water and Sewerage, Wilmington, N. C.

*(*Winner of the Moffitt Cup, awarded annually to that member securing the largest number of new members during the year.)*

produced "Nightmare of Our Super"—and if the reader sees it in the A. W. W. A. Journal it is worth taking home to read and sympathize and chuckle over. From drunken joy-riders (on wartime pay) showing absolute disregard for M. Moffitt's fireplugs to the job of getting a water supply free of salt, running pipe lines out like spokes of a wheel, and now a brand new Filtration Plant going in under an AA2X priority rating—Moffitt hasn't had a great deal of sleep in late months. In fact they actually had him in the hospital for repairs at one time

Honored
W. M. Franklin, Supt., Water and Sewage Treatment Charlotte, N. C. (Voted the Fuller Award)

Secretary
R. S. Phillips, Supt., Water and Sewage Treatment Durham, N. C. (His section got him deferred)

—but he's out again and the old never-die "Rebel" Moffitt.

A Fight for Water Equipment and Supply Depots

Back in harness again this same Moffitt has started something in North Carolina when the Governor replied to his recommendation that the state couldn't establish five depots of emergency parts and supplies for water works, such depots to be financed by the state and located at strategic points based on population centers. As a means of transportation Moffitt suggests that trucks and personnel of the N. C. Highway Dept. be scheduled for the purpose and likewise for transporting experienced water works personnel, going to the aid of a stricken community from nearest points.

The introduction of this topic and the discussion following from the floor gave evidence that there were 265 communities in North Carolina of less than 5,000 population. To avoid the need for much duplication and waste incurred by this group of communities, if individual inventories be adequate for emergency needs it was the sense of the members that the state should finance control emergency depots in one or another form. In consequence a resolution was offered and adopted, which advocates the establishment of such state financed and

controlled materials depots, the inventory of which is to be developed by a special committee in the Section. The resolution also called for trucking service by the Highway Department.

A second resolution called for legislation making it legal to transfer manpower from one to another Water Department and to fix the responsibility for compensation and

Hosts and New Vice-Chairmen

Kenan Rand, Mayor pro-tem of Durham

Henry A. Yancey, City Manager of Durham

John R. Purcer, Jr., President, J. R. Purcer, Sales Engrs., Charlotte, N. C. (New Vice-President of the Section)

accident (en-route or on the job) on the borrowing community.

It will prove interesting to see what develops from this move started in North Carolina. Possibly now that bombings seem so remote nothing will come of it, but it sounded like a very sound idea basically for the general good of the 265 small municipalities of a wealthy state in which such communities are as a rule sufficiently closely located as to make the scheme more attractive and practical than in some other states.

Fuller Award to Franklin

One of the ceremonies during the Annual Dinner was the announcement of the Geo. W. Fuller Award to W. M. Franklin, Supt. of Water Purification and Sewage Treatment, Charlotte, N. C. Mr. Franklin was cited for his work in rebuilding the N. C. Section, the development of the Operator Certification System in N. C., and services in advancing water works operation and the interests of water works men.

Jordan on the "Water Front"

Following this and the Moffitt Cup presentation Harry Jordan gave a brief two pointed talk on "Where Does the Water Works Operator Go from Here?" (Our title, with apologies, but that was the gist of his talk in which he deplored the fact that many water works men with a high and patriotic duty to perform on the "home front" had the feeling that they might be considered slackers if they made any move to stick to the job that was far more important to the greatest numbers of Americans than leaving home to wear a uniform and perhaps carry a gun. An amateur on the home water production job and an experienced water man out of place in the army wasn't the formula to win a war. This in effect was the plea of A. W. W. A.'s Secretary — who went through World War I and knows what Washington thinks about water supply in the war picture.)

Officers Elected

The following were elected new officers of the Section re-named to the positions indicated:

Chairman
W. H. Hall,
Dean of Engineering,
Duke University, Durham.

Vice-Chairman
John R. Purser, Jr.
President, Purser Sales Engineering, Inc., Charlotte.

Secretary and Treasurer
Robert S. Phillips,
Supt., Water Purif. and Sewerage Treatment, Durham.

A. W. W. A. Director
Wm. M. Piatt,
Consulting Engineer,
Durham.
(To succeed J. W. Kellog as Director at the close of A. W. W. A.'s 1943 Conference.)

Trustees
J. W. Kellog, Asst. Director,
State Lab. of Hygiene, Raleigh.
W. E. Yow, Supt. of Water,
Asheboro.

Technical Sessions

(Chairman, D. M. Williams, Presiding.)

The opening paper was presented by J. W. Kellog, Ass't Director, State Laboratory of Hygiene, Raleigh, N. C., who is now serving the Section as A. W. W. A. Director. His topic was "Wartime Water Supply Problems" in which he discussed the possibilities of poisoning water supplies but felt little danger in this direction existed because of the large quantities of poison required and the task of injecting it.

Manned the Registration Desk

Mrs. Edwina Wilson and Mrs. E. F. Dement, of the Durham Water Department, the latter being Secretary to Chairman Williams and Secretary Phillips

An indication was that water supply poisoning had never been attempted in either the last or the present World War. However, he did not wish to say that such a thing was an absolute impossibility. He advocated systematic routine tests for pH alkalinity, residual chlorine oxygen demand and chlorine demand. These tests would promptly detect any major contamination or poisoning of the supply without going into complicated testing.

Mr. Kellog felt that residual chlorine should be maintained throughout the system, emphasizing ammonia chlorine treatment and definitely cross connections should be eliminated.

Mr. Kellog stated that simple tests for contaminants were being developed for distribution to water operators and a sampling program would be supplied also by the State Dept. of Health.

Programmers

W. A. ("Art") Welch, Industrial Chemical Sales Div., New York

R. W. ("Bob") Luther, Supt., Purification & Pump., Elizabeth City, N. J.

E. Shaw Cole, Chief Engr., The Pitometer Co., New York

The discussion of Mr. Kellog's paper and answers to questions are not being printed. In any event it is doubtful that such material could get by the Censor's office. (In this direction "Water Works and Sewerage" lost 3 pages of the December issue in meeting requirements of the Censor's office. Fortunately, only those copies leaving the country had to have the censored pages left out.)

"Maintaining Public Water Systems for Civilian Defense," by Major Daniel W. Evans, Regional Sanitary Engr., U. S. P. H. Service, attached to OCD., Atlanta, Ga.

Major Evans, characterizing himself as a one-time small water operator, presented a pleasing informal talk on his topic, rather than read his prepared paper. He began by saying that water works managers had not been given their deserved

recognition in early Civilian Defense Planning but now the picture is different and water supply is recognized as the backbone in civilian defense. He was of the opinion that water works associations should see to it that the local water superintendent gets the recognition deserved in the local defense picture and is given full charge of the water situation without having to take orders in an emergency—in short he should be director and not an office boy in civilian defense planning.

He had asked the N. C. Section to sponsor a defense training course for water operators and auxiliaries. (Chairman Williams later explained that a committee had drawn up plans for such training but it hadn't gone into effect yet.) Outlining some "thoughts of an operator looking to defense" Major Evans said the first thing was necessary tools and materials for repairs and replacements on the system; ample chemicals for treatment; adequacy of supply, which involved locating all available auxiliary supplies in case of need; training auxiliaries and preparing for the worse that could happen; looking the manpower problem squarely in the eye and training women for every possible job they might fill—even as meter readers and filter operators, as well as laboratory technicians. The water superintendent should plan for water trucking also. As to the effects of main breaks in pressures, he thought that the National Board of Fire Underwriters were too optimistic in publication of the article on the limited area affected by a main break to serious proportions in respect to fire fighting pressures. The safest course would be that of assuming the necessity of break shut off immediately and train crews and plan this action even while bombs are falling.

W. M. (Bill) Piatt, Consulting Engr., Durham, N. C. (Elected A.W.W.A. Director)

Sarah Philhowen, Water Dept. Chem., Gastonia, N. C. (N. C.'s first lady Wat. Wks. chemist)

Concerning safety of supply it was the major's opinion that water officials should be always safe rather than sorry. In this direction it was better that chlorine be objected to than risk an outbreak, therefore 0.2 ppm. of residual chlorine should be the order of the day throughout the pipe system. He also cited the need for ultra care in main laying and repairs, since strange articles were too frequently found in mains which had supposedly been carefully inspected during laying and flushed before use. One of the greatest dangers in water supply protection, maintenance, and planning was assumption. Little can be assumed and much needs proving in a matter so important as public water supply.

Warren H. Booker, Chief Engineer, N. C. State Dept. of Health, followed Major Evans with a review of "the North Carolina 10 Point Program" set up to be checked with water operators. Amongst the 10 items the more immediately important was the return of information by water managers on existing inventory and establishing the surplus (if any) as defined in the revised P46 order of October 10/42. Other points covered auxiliary supply and possible interconnections with industrial supplies on neighbor municipal systems; the need for auxiliary mobile pumping equipment; good valve records; mapping of the distribution system; inventory checking for weakness in the more essential supplies and materials; organization for emergencies with auxiliaries trained; plant and source guarding at vulnerable points; emergency reserves to be marked for use only with superintendent's approval.

Concerning the last, most plants have 5 points to consider guarding as the most vulnerable points. A State Sanitary Engineer will where requested, survey the system and the protection advocated discussed confidentially. In connection with the inventory survey 81% of those towns above 5,000 population had reported inventory. Including all plants 50% had reported inventory, making possible the 38 page "Master Inventory" which was distributed during the Conference.

It was at this point that M'Kean Moffitt brought up the desirability of the 5 materials depots for North Carolina, in order to more effectively take care of the many small systems which hardly knew what the words "inventory and surplus" meant—much less having any record of the first or supply of the latter. The resolution addressed to the Governor and N. C. Legislature citing the need and justification for such state owned and operated emergency supply depots was then drawn, passed and handed over to D. M. Williams, Legislative Committee Chairman, for handling and transmission.

Movie of Chicago Conference Shown

The very excellent color film made by Arthur Welch, and coworkers in the Industrial Chemical Sales Div. of the W. Va. Pulp and Paper Co. of activities and exhibits during the A. W. W. A. 1942 Wartime Conference in Chicago was shown by Messrs. Welch and Sigworth. The showing followed a luncheon given by the Section to

Jerry McCarthy and Francis Burr, Monsanto Chem. Co., Boston

Ed Shiddell, Electro-Rustproofing, Philadelphia, and Max Howe, Supt. of Water, Union, S. C.

J. H. Sugg, Chief Operator, Durham, N. C., and Roland G. Shell, Operator, Roanoke Rapids, N. C.

Fred H. Hicks, Shop Foreman, and J. L. Greenlee, Asst. Supt., Charlotte, N. C. (rear row) and Fred Dimmick, R. D. Wood Co., Richmond, Va.

(1) (2) (3) (4) (5)

(1) *Chas. F. Thomas, General Manager, Roberts Filter Mfg. Co., Darby, Pa.*

(2) *C. B. Williams, Supt., Water and Sewerage, Lexington, N. C.*

(3) *Earnest Boyce, Lt. Commander. Sr. San. Engr., U.S.P.H.S., Washington*

(4) *Tom Halpin, Sales Manager, A. P. Smith Mfg. Co., East Orange, N. J.*

(5) *A. R. Murphy, Division Mgr., Wallace & Tiernan Co., Knoxville, Tenn.*

A. W. W. A. officials in attending the meeting, and Arthur E. Gorman, Chief of W. P. B.'s new Water Production Section, as special guest.

Gorman on Water Supply Needs

Following the luncheon Mr. Gorman gave one of his characteristically straight from the shoulder (and heart) talks on water supply needs and the use and abuse of materials.

He said that a long pull war was looked for in Washington and planning was done accordingly. The most critical period was to be the 8 months ahead and water works would be required to live on the surplus known to exist in the store yards and stock rooms of the industry. On the limited materials allocated for water supply operation and maintenance had first call. New projects and betterments were practically out for the next several months at least, unless a direct war project. Gorman stressed the need for stretching, saving and sharing as never before. In this direction he said that money otherwise going into extensions etc. could well be spent for making leakage, flow and pressure surveys; cleaning and relining mains; rating up filters to avoid plant enlargements; conserving supply by reducing pressures when permissible; reducing peak loads; waste curtailment and lowering wasteful consumption.

Concerning Mutual Aid and the Surplus Inventory, Mr. Gorman reported that W. P. B. was to survey all water works serving communities above 5,000 population for surplus or shortage in inventories. Copies of such records would go to all State Water Coordinators.

Mr. Gorman then outlined the new plan of W. P. B. involving a composite of the priorities system with the allocation scheme—the Controlled Materials Plan. This system requires close study by W. P. B. of industry needs and necessitates ultra care and honesty on the part of the applicant seeking materials. There also must be close cooperation between operators and manufacturers or purveyors.

In questions and discussion following it was stated by Mr. Gorman that in ordering materials needed in a hurry under authorization to apply an AA2X priority in water or sewage equipment (purification, treatment, pumping, distribution) it was advisable to file copies of such ordering with the water section of W. P. B. Where help may be needed in providing real emergency orders call on the Water Section. To get what is needed it is only necessary to give a full explanation.

Mr. Williams (Durham) pointed out the difficulties experienced in getting the minor items but much needed ones usually secured through local merchants or distributors. In particular, dry cells for a pipe locator. He had learned that it was best to go direct to the manufacturer for parts needed to operate his equipment.

Mr. Moffitt (Wilmington) told of the slow coming of a needed valve bonnet. If the present bonnet failed a real emergency could exist—no water for a time, but how long? Was this eligible for an AA2X priority? Mr. Gorman said that it apparently was since P46 permitted advance purchase for items expected to fail in reasonable time.

Replying to a question as to how water works without 1940 inventory was to arrive at what is surplus in 1942, Mr. Gorman said that such operators could be trusted to set up what they considered a legitimate working inventory for the particular system.

L. H. Enslow (Editor, WATER WORKS & SEWERAGE) wondered if this mater of establishing an inventory pattern for various sizes and classes of plants might not be a job for a special Section committee such as was practiced in the Maine Water Utilities Assn. Mr. Gorman replied that would be a most satisfactory and practical method of indicating to water operators what should be considered a normal working inventory, from which surplus could be established as well as deficiencies.

Mr. Gorman warned water superintendents against letting *anyone* have any surplus material, except another water worker manager, until securing W. P. B. (Water Section) approval. To do otherwise would be a breach of the P46 order. He again stated that it would prove wisdom to file special application with the Power Branch for anything ordered with AA2X rating, although the order should be placed with the supplier simultaneously.

In answer to question of inventory needs in 1940 vs. 1942 when much greater demand existed, Mr. Gorman cited the P46 ruling that materials in inventory could be increased in the rates of population or consumption increase, particularly those required in purification and pumping.

(1) (2) (3) (4) (5)

(1) *G. P. White, Engineer, Roberts Filter Mfg. Co., Darby, Pa.*

(2) *E. H. Moss, Supt., Sewage Plants, Greensboro, N. C.*

(3) *Homer E. Beckwith, Engr., The Pitometer Co., Pittsburgh, Pa.*

(4) *Leroy F. Jackson, Supt. of Water, Henderson, N. C.*

(5) *Stephen R. Kin, San. Engr., Camp Butner, N. C.*

"The Value of Pitometer Studies to Meet Present Emergencies and Post War Conditions," by E. Shaw Cole, Chief Engineer, The Pitometer Co., New York, N. Y.

"Water Main Cleaning in the War Effort," by A. Clinton Inglee, President, National Water Main Cleaning Co., New York.

The two above papers, presented at a well timed place following Mr. Gorman's talk, are here listed for record. Both are to be found printed in full in our December issue because of their especial interest and importance at this time when "Save, stretch, and share" is the order of the day.

Howard A. Johnson
Supt. of Filtration, Danville, Va.
Fred E. Stuart, President,
Stuart-Brumley Corp., Baltimore, Md.
R. T. (Bob) Mills,
Supt. of Water, Southern Pines, N. C.

"The Alum Situation," was reviewed by Fred E. Stuart, President, Stuart-Brumley Corp. and Activated Alum Corp., Baltimore, Md.

Mr. Stuart in commenting on alum now produced under wartime specifications and made from domestic bauxite, low in alumina and high in insolubles, stated that the 8 to 15% insolubles would probably cause operators to use stirring devices and jets to keep the mud from choking feed lines solution chambers, tanks, etc. The soluble alumina content would be only 14% (or thereabouts) as compared to 17% pre-war alum. The iron content might reach 3% in some productions but generally would be lower. The requirements of the Office of Transportation that can be loaded to certain minimum tonnages would necessitate minimum car shipments amounting to about 40 tons for the wartime alum.

(1) (2) (3) (4) (5)

Wm. Lybrook,
Supt. Water and Sewerage, Greensboro, N. C.

(2) Frank C. Taylor, Dist. Mgr., Pittsburgh-National Meters, Columbia, S. C.

(3) Dan W. Evans (Major), Regional Engr., U.S.P.H.S., Atlanta

(4) F. W. Taylor, Branch Mgr., Chain Belt Co., Atlanta

(5) E. A. (Siggie) Sigworth, Industrial Chemical Sales, New York

"Experiences With Shallow Wells at Elizabeth City, N. C.," by Robert W. Luther, Plant Superintendent, Elizabeth City, N. C.

Mr. Luther's interesting review related experiences with water production from a battery of 114 shallow driven wells of 2 inch diameter later supplemented by 14 gravel-pack wells and now to be extended to cover 200 acres and the putting down of 100 of the 10" diameter gravel-pack wells with expected safe yield averaging 5 gpm. from each such well costing $100 each. The water from the small driven wells ran high in fine sand, from 18 to 20 ppm. and CO_2 150 ppm. was delivered to the filter plant now converted to a softening plant. The larger gravel-pack 10" wells yield water essentially free of sand and considerably lower in iron content which causes impillar incrustation and chokage of strainers; cleaned with inhibited muriatic acid.

Mr. Luther stated that the Elizabeth City well field had started as an experiment and had developed into the largest American experimental grounds for shallow wells, involving several sizes of drive points and diameters of the gravel-pack wells before reaching a decision to put in 100 of the latter.

Camp Buttner Plants Inspected

On the final afternoon a trip was made by bus to the filtration plant and sewage treatment works serving Camp Buttner near Durham. Impressive was the preparation of the water in the mixing and flocculating units. So free of floc is the water going onto the filters that runs have to be "killed" long before the available loss of head has been consumed.

Conservation in 1942
Some Interesting Highlights

The following highlights on the conservation and scrap recovery program in America are interesting. We noted the following comments in Chicago Bridge & Iron Co.'s *"Water Tower"* and since most of us are doing our part in the materials recovery campaign we believe the readers of WATER WORKS AND SEWERAGE will find the report interesting.

The most important salvage need for the year was iron and steel scrap. During the early months of 1942 between 40 and 45 steel-making furnaces were closed down for lack of scrap. Then the "Salvage for Victory" drive got started and, with the exception of one open-hearth furnace which was shut down for a single week, no furnace has had to cease operations since July 27th.

The scrap rubber drive last June netted 450,000 long tons of rubber, a figure which exceeds by 158,000 long tons the 292,000 long tons consumed during the entire year of 1941.

In six months the waste paper drive went over the top so far that by the end of May the commodity was a glut on the market. During those six months 1½ million more tons of waste paper were collected than in the same period for 1941.

Tin, which used to come from Malaya, now held by the Japs, was mined last year from the country's bathroom cabinets and kitchens. During the single month of October detinning plants received 12,000 tons of tin cans. Returned collapsible tubes that once contained shaving cream and toothpaste yielded 80 tons in the same month.

By September the amount of scrap copper recovered for war production purposes had already passed the total copper scrap collections for the whole year of 1941.

N. Y. SECTION HOLDS ANNUAL WINTER MEETING

Post War Planning, News from Washington, Plant Protection and Mutual Aid Featured in Full Program

By HARRY A. FABER
Associate Editor

A CAPACITY attendance at the meeting of the New York Section of the American Water Works Association in New York City on December 30 included guests from Connecticut, New Jersey, Pennsylvania, representatives of the armed forces and of the OCD. Chairman Hugh Dewey, Buffalo, presided.

That the membership list now stands at 498 was announced by Jack (J. M.) Diven, chairman of the Membership Committee. He praised those who had made this growth possible and asked that even further assistance be given.

Dr. Abel Wolman
Johns Hopkins Uv.
Baltimore
(Pres., A.W.W.A.)

Hugh S. Dewey,
Mgr., Western N. Y. Water Co.
Buffalo
(Section Chairman)

W. T. Miller, chairman of the Committee on Mutual Aid and Group Meetings, described briefly the activities of his committee. These are predominately related to the extension of mutual aid through the functions of a centralized inventory bureau and through the participation of members in regional group meetings. He gave great credit for progress in mutual aid extension to State Water Coordinator Earl A. Devendorf of Albany.

President Wolman on Plans for Future

"How Water Works Can Relate Themselves to the Post War Planning Program," by Abel Wolman, President, A. W. W. A., Professor of Sanitary Engineering, Johns Hopkins University, Baltimore, Md.

The challenge of readjustment to a post-war world, said Mr. Wolman, requires the best thinking of engineers and public administrators. This challenge must not be neglected because of our concern with present problems. Plans of utilities are generally made as programs in terms of decades rather than of months, and advanced thinking of this nature cannot be delayed if financing and construction are to proceed rapidly after the war.

The problem of post-war readjustment includes four primary elements: (1) More than one-half of our national income now devoted to war purposes must be reallocated and readjusted to peacetime enterprises. (2) Approximately 30 million men now in war industry must be relocated in different fields with the least upset. (3) A tremendous job of industrial conversion—estimated at a total of 23 billion dollars annually—will be required for private industry alone. (4) Programs of community reorientation must be undertaken, including all types of public services.

Similar post-war planning is already being undertaken by other countries, including England, China and even by most of the governments in exile. Mr. Wolman called attention to some of the agencies in the United States which have already approached this problem. Legislative action has been developed by nine States to sanction financial reserves toward the undertaking of post-war projects. Private groups have, in certain instances, inaugurated programs. For example, a Baltimore transit agency has underway plans, specifications and surveys which will require the expenditure of large sums. Congress proposes the establishment of war savings bonds to be purchased by States and municipalities; these will be redeemable at fairly high rates of interest if applied to post-war projects—otherwise, the interest credited will be at the regular rate. Under another plan (the Beiter bill), funds would be provided for preliminary development of works design and organization.

Mr. Wolman called upon the American Water Works Association to make clear to the 13,350 water works of this country that post-war planning of enterprises is necessary—now.

Malcolm Pirnie (Consulting Engineer, New York), in discussing Mr. Wolman's paper, emphasized that this same problem has arisen before, especially during the last period of depression. Productive work, in order to increase wealth and maintain standards of living, must be provided in order to rebuild. If this is done, it is evident that the world can recoup its present losses. Planning for the future *is* necessary and should be expanded to apply in world terms.

"Latest Information on Priorities and Procedures in Washington," by Harry E. Jordan, Secretary, A. W. W. A., New York.

Mr. Jordan called upon Walter J. Ackerman, assistant to Arthur Gorman, Chief, Water Production Section, Power Branch, WPB, to comment on the present functions of that unit. Mr. Ackerman, long a member of the New York Section, praised his "boss" for gradually bringing order out of the previous chaos. Mr. Gorman has built up a competent staff of experienced water works men and has concentrated upon simplification of relations between the Power Branch and water utilities. Prompt assistance can be expected, but sufficient detailed information must be supplied with appeals or applications.

Rollo Blanchard, V.P.
Neptune Meter Co.
New York
(Section Secretary)

Earl H. Devendorf
State Dept. of Health
Albany
(State Water Coord.)

Mr. Jordan then discussed in some detail the problems related to selective service. According to a new list of essential occupations, issuance of which is expected shortly, public

water supply is considered an essential occupation. Water works and other utilities must cooperate with the military and directly related war industries, but Mr. Jordan advised careful rereading of the statement by General Hershey, Chief of Selective Service, as published in the A. W. W. A. Journal last October.

With reference to needed information requested in a questionnaire

J. M. Diven, Jr.
The Leadite Co.
New York
(Chr. Membership Com.)

W. T. Miller, Jr.
Supt. of Water
Ossining, N. Y.
(Chr. Mut. Aid Com.)

which A. W. W. A. headquarters recently sent to cities of 10,000 or more population asking data on the use of coal, Mr. Jordan pointed out the necessity for such information. Some basis of fact must be available in order to consolidate needs for representations to Washington authorities. The returns from this questionnaire have been lamentably slow; of 892 requests mailed on November 19, replies had been received from only 50 per cent one month later; following another appeal, some 25 per cent of the total have still not replied. Since the necessary data must be readily available, and like other information which may be needed for specific purposes, Mr. Jordan asked those called upon to cooperate promptly.

Water works men are to be commended, in his opinion, for their patience and general willingness to be of service. This has been demonstrated long before the war, when earthquakes, floods and hurricanes evoked the highest degree of cooperation among utilities. Now they are attempting to follow the regulations of the new P-46 order, with special reference to the exchange of surplus material. But water executives have been directed by various federal boards and divisions to take various and conflicting actions.

Mr. Jordan expressed concern and disappointment over the delay in respect to the slowness in the development of definite and specific procedures by W. P. B. for the disposal or redistribution of surplus inventories. He stated that A. W. W. A. has called this delaying situation to official attention in Washington, pointing out that the water field is standing ready to cooperate gladly with those who know what they want done, and will say so.

"Civilian Defense Requirements for Water Works," by Major John H. Brewster, Sanitary Engineer, U. S. P. H. S. (R), Second Civilian Defense Region.

Major Brewster explained that relations between OCD activities and the water works utilities involved largely: (1) maintenance of continuous water service to defense plants, and (2) provisions for protection and rehabilitation. Since there is little new material to present on these subjects, he introduced two specialists who did have new and unusual information directly applicable to water plants. Similar specialists are now available at all regional civilian defense offices for consultation on individual problems.

Mr. Francis Keally, Camouflage Specialist, described the principles and practice of concealing or hiding objectives from enemy aircraft. Lantern slides were used to illustrate the function and application of different types of camouflage.

Mr. H. E. D'Andrade, Blackout Specialist, explained important advantages of dimouts and blackouts in creating confusion as to the bomb target areas. He also used slides to show methods of accomplishing plant blackouts and of providing protection against flying glass.

"Problems of New York State Water Supplies," by Earl Devendorf, State Water Supply Coordinator, Albany, N. Y.

In this review of progress made during 1942 in the operation of the Mutual Aid plan for water service, Mr. Devendorf expressed his appreciation for the cooperation which was forthcoming from both zone coordinators and all local water officials. The record of accomplishments is really astounding. Nevertheless, constructive improvements are still possible, and new problems must be expected during the coming year.

Fundamentally the same program as formulated by a committee of practical water works experts (appointed by the Mayor's Conference and State Department of Health) has remained unchanged—a proof that the original conception was sound. A large number of states have been guided by the New York State plan in developing their own, and the same is now recommended by the OCD for all states. Progress in Mutual Aid plans for water utilities has been commended as the most significant accomplishment of the year in the water works field. Specific objectives include:

1. Promotion of all practical interconnections between adjacent public water supplies. There are now 221 such interconnections ready for operation in case of need. Another 100 are desirable but are not immediately possible because of WPB restrictions on needed materials.

2. A similar interconnection between public water supplies and safe *approved* water supplies of industries. About 40 such interconnections are now maintained.

3. Preparation and maintenance of up-to-date maps and records of distribution systems, valve locations, etc., in duplicate. Of approximately 1,200 water systems in the state, 424 now have such maps and records. Concentration on this objective will be high-lighted during the coming year.

4. Testing of valves and fire hydrants to assure proper functioning at all times. A definite program to insure this condition is recommended to each local water authority.

5. Collaboration between water and fire officials in each locality has been repeatedly stressed but needs further emphasis. The possible use of emergency water supplies pumped into the regular system makes this particularly important, since 399 municipalities have made advance plans for such practice.

6. Cooperation between water officials and electric power or other related interests. Advance planning for auxiliary power sources or emergency water sources is an important matter. Only 42 municipalities have given more than casual consideration to this objective.

Maj. J. H. Brewster
U.S.P.H. Service
New York

J. W. Ackerman,
Engr., Water Section,
W.P.B.
Washington

7. Water officials must collaborate with representatives of industry and with fire officials in regard to fire protection service furnished to war

industries. This has generally been done.

8. The best possible protection against sabotage and subversive activities. Many precautionary measures have been adopted, but secrecy as to details is necessary.

9. Inventories of water works equipment, personnel, materials and supplies are to be filed with the Zone Water Coordinator. To date 702 local water authorities have filed such inventories and this important feature of the plan is ready to go into action at any time—whenever an emergency requires the extension of assistance from one municipality to another.

10. Integration of local water departments with civilian protection machinery in each community. The early confusion in this respect has been passed and the Mutual Aid Plan is definitely incorporated as a division under the State Director of Civilian Protection.

11. The organization and training of crews of auxiliaries has been an important objective. While much has been accomplished, an ample reservoir of such personnel is not yet available. About 30 local schools have provided instruction to some 1,500 auxiliaries from 123 municipalities.

While much remains to be accomplished during 1943, it is evident that definite progress has been made. While this may be a difficult year, through loss of men to military service or war industry or through even more critical situations as to material availability, the Mutual Aid program offers the means of reducing these difficulties to a minimum.

Ed. Note—In New York this week the Diven Medal Committee of A. W. W. A. recommended, and the Board of Directors approved, the recognition of the work of Mr. Devendorf in his development and prosecution of the Mutual Aid Plan in New York State through Association channels by awarding the prized Diven medal—A. W. W. A.'s highest award for conspicuous services—to State Water Coordinator Devendorf.

Harold Brigham President of NEWWA, Dies

Harold Brigham

Harold L. Brigham, Superintendent of the Water and Sewerage Board of Marlboro, Mass., and the president of the New England Water Works Association, died on January 8th after an eight weeks' illness, in the Thorndike Hospital, Brookline, Mass.

Mr. Brigham was born in Marlboro on Feb. 11, 1893. He atended Mass. Inst. of Technology where he took special courses in water supply practices. In 1922 he went to work with the Dept. of Water and Sewerage of Marlboro and 10 years later became its head.

The same year (1932) Mr. Brigham became a member of the New England Water Works Assn. and after another 10 years found himself again at the top, as president of the Association, to which position he was elected in September.

Mr. Brigham was also active in the New England Sewage Works Association. He leaves a widow and four daughters.

Blanchard and O'Brien Appointed to AWWA's Committee on Wartime Activities

Rollo K. Blanchard, Vice President, Neptune Meter Co., and Herbert P. O'Brien, President, A. P. Smith Mfg. Co., have been appointed members of the important Committee on Wartime Activities of the American Water Works Association.

Mr. Blanchard takes the place of John A. Kienle, who has resigned, and Mr. O'Brien is added.

W.W.&S.' Oldest Subscriber Tom Amiss

Sup't of Water and Sewerage, Shreveport, La.

Tom Amiss

Some months ago we printed an item to the effect that as far as our records indicated our oldest continuous subscriber was Thos. L. Amiss, Supt.-Engineer, Dist. of Water and Sewerage, Shreveport, La.

The records show that Mr. Amiss has been a continuous subscriber to WATER WORKS AND SEWERAGE, and to its antecedent, WATER WORKS, since 1919—the same year he joined the American Water Works Association, which he is now serving as Director for the Southwest Section. Therefore Mr. Amiss has been a member of A.W.W.A. and a subscriber to WATER WORKS AND SEWERAGE for 24 years—almost a quarter of a century.

We published the statement that we believe Mr. Amiss' record as a subscriber made him our oldest continuous reader, with the suggestion that we would stand corrected if any subscriber could show a record of longer subscribership than 24 years. To date we have had no claim to longer subscribership than that of Mr. Amiss, and we henceforth must rank him as our "Senior Subscriber" who next year becomes a "Silver Anniversary" 25-year reader.

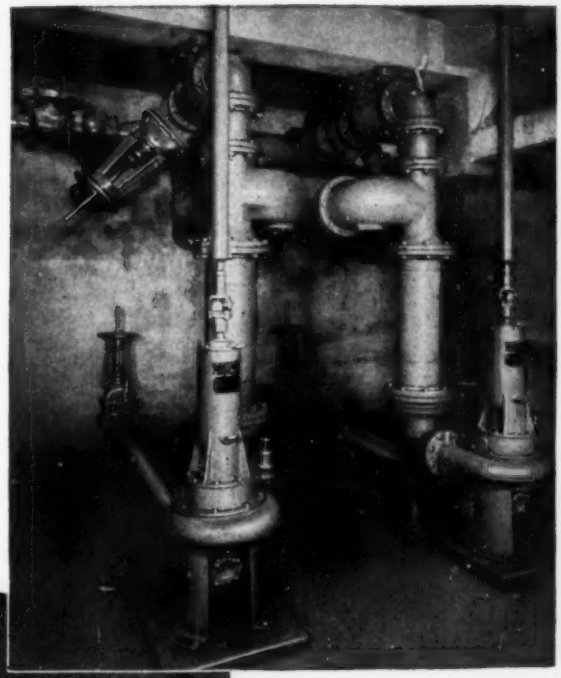
Inasmuch as the most famous men in these times are the dollar-a-year men serving our nation, we are putting Mr. Amiss in this classification by making him a "Dollar-a-Year Subscriber." To catch up on salary in arrears he receives a $25 check as payment in full for 25 years of reading 300 issues of the magazine. In recognition of Mr. Amiss' status as our oldest subscriber, we have no medals or honorary memberships to confer, but we can do the next best thing at our command and award to him a "Life Subscription" to the magazine.

Mr. Amiss has the distinction of having been connected with the Shreveport Water and Sewage Department for 42 years and having been its Superintendent for the past 25 years.

Tom Amiss is the youngest looking 42-year service man that we know and since he henceforth will be carrying a "Life Subscription" to the magazine WATER WORKS AND SEWERAGE merely says—long may he be a subscriber!

FLUSH-KLEENS AND COMMINUTORS PROVE THEMSELVES AGAIN IN THIS WAR EMERGENCY

By Eliminating Sewage Pump Clogging Caused by Abnormal Solids Loads as Women Replace Men in Factories.

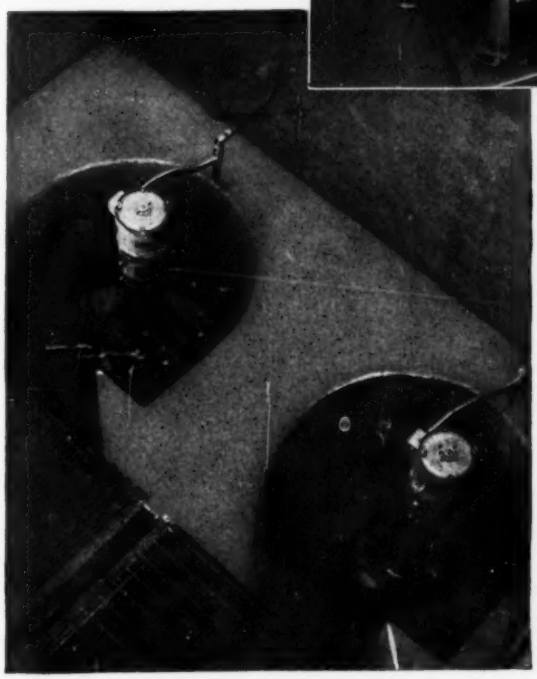


Flush-Kleens Never Clog.
Rags Do Not Reach Impellers

FLUSH-KLEENS AND COMMINUTORS are being installed in war production plants to prevent shut-downs because of insanitary conditions resulting from clogged sewage pumps.

FLUSH-KLEENS CANNOT CLOG because rags and other coarse materials never reach the impellers. For seventeen years Flush-Kleens have been successfully handling peak rag loads in the sewage of hospitals, department stores, theatres, hotels, restaurants and other places frequented by the general public.

COMMINUTORS installed ahead of troublesome sewage pumps cut up rags that cause pump clogging. More than 900 installed in sewage treatment plants for municipalities, institutions, and Army and Navy projects.



Comminutors Cut Up Rags that Cause Pump Clogging.

RECENT INSTALLATIONS

Sixty-five duplex sets of Flush Kleens have been installed in war production plants to insure trouble-free sewage pumping.

Fifty Comminutors have been installed in war production plants ahead of sewage pumps to eliminate continuous clogging trouble.

PREVENT TROUBLE

Specify Flush-Kleens on new jobs.

Replace troublesome sewage pumps with Flush-Kleens, or . . .

Install Comminutors ahead of troublesome sewage pumps to cut up the rags that cause clogging.

CHICAGO PUMP COMPANY

SEWAGE EQUIPMENT DIVISION

2300 WOLFRAM STREET — **CHICAGO, ILLINOIS**

Electric Pumps: Circulating, Bilge, Scru-Peller, Flush-Kleen, Plunger, Fire, House, Condensation, Vacuum.

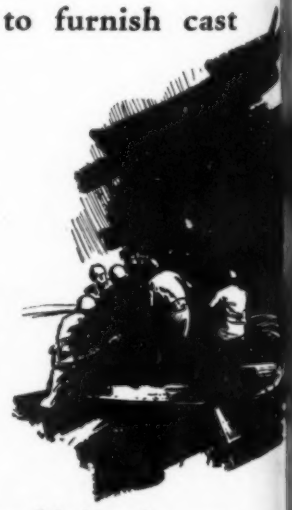
Swing Diffusers, Stationary Diffusers. Mechanical Aerators, Combination Aerator-Clarifiers, Comminutors.

Ask for Flush-Kleen Bulletin 122
Comminutor Bulletin 185

A report to our Customers including Uncle Sam

THIS is January—the first month of the second year since Pearl Harbor. We—ıe members of the Cast Iron Pipe Research ssociation—makers of pipe for water, gas ıd sewer mains—are still in the position of having thousands of customers but *only one* to whom we can *guarantee* delivery under wartime restrictions.

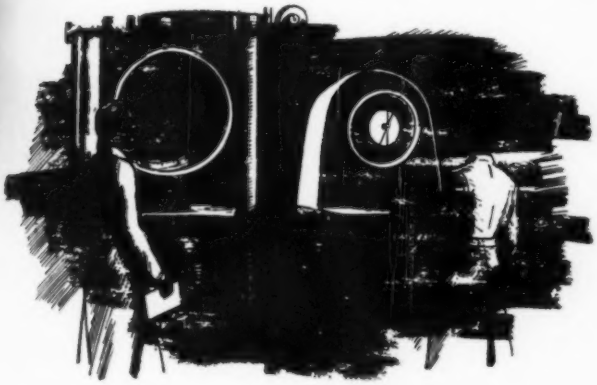
That No. 1 Customer is Uncle Sam. And in spite of increased capacities, our facilities have been strained to the last ladle to furnish cast iron pipe for *Army and Navy training camps; airfields; naval bases; ordnance arsenals; tank and airplane plants and shipyards, and their housing requirements, as well as essential civilian projects.*



Also, we are making or machining in our foundries and machine shops — *guns; shells;*

tank and plane parts; machine tool castings; liners for Diesel Marine engines; propeller shafts and other ship castings; chemical and other castings; presses for making armor plate, shells, and for dehydrating gunpowder.

To thousands of our customers, whose requirements for needed extensions of water, gas



and sewer mains we have been unable to supply, we have this to report: The clouds of war have a platinum lining.

When you can get the cast iron pipe you want, and need, it will be better than two years ago—*better than ever.* Our stepped-up wartime production alone would be bound to reflect progress in design and manufacture. The *plant research* of our members—the *field research* of our Association—the intensified *laboratory controls,* from raw materials to finished product, made necessary by greater production—are a continuing program.

For this *improved cast iron pipe* which we are delivering today to our No. 1 Customer—which few of our regular customers have had an opportunity to lay—we began to prepare ten years before Pearl Harbor. Two years ago, our co-operative study with leading consulting engineers representing pipe users, under the auspices of the American Standards Association, came to fruition in the adoption of the

A. S. A. Law of Design for cast iron pipe in underground service.

We are now making cast iron pipe according to this new *Law of Design*—the most modern of all pressure pipe for water, gas and sewer mains—with all the inherent virtues of the cast iron pipe you have previously laid. This is pipe worth waiting for if your requirements for *permanent installations,* can possibly be deferred. We repeat—pipe worth waiting for. Cast Iron Pipe Research Association, Thomas F. Wolfe, Engineer, Peoples Gas Building, Chicago.

MEMBERSHIP OF THE

CAST IRON PIPE

RESEARCH ASSOCIATION

Alabama Pipe Company
American Cast Iron Pipe Co.
James B. Clow & Sons
Donaldson Iron Co.
Glamorgan Pipe & Foundry Co.
Lynchburg Foundry Company
McWane Cast Iron Pipe Co.
National Cast Iron Pipe Co.
Pacific States Cast Iron Pipe Co.
United States Pipe and Foundry Co.
Warren Foundry & Pipe Co.
R. D. Wood Company

Look behind this CURTAIN OF STEEL

See how America is conserving this vital war material on the *production* front for use on the *firing* line. Step into a Lock Joint fabrication plant and note the economy and skill with which it employs its steel allotments.

The core and ribs of each length of pipe are formed by a steel cylinder and encircling cage—and it is this steel skeleton that safeguards against pressure and stress. By adapting pipe design to closely conform with the hydraulic and operating conditions along the route of installation, Lock Joint Reinforced Concrete Pressure Pipe provides maximum strength with a minimum use of war-essential steel.

Behind America's battle lines lie the water supply lines of your community. Keep them flowing. Insure their long life and dependability. Specify Lock Joint Reinforced Concrete Pipe.

LOCK JOINT PIPE COMPANY

Established 1905

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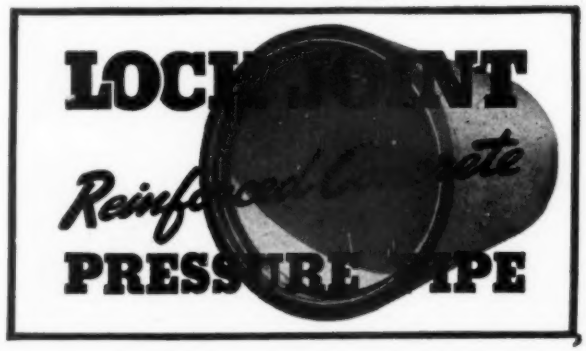


SCOPE OF SERVICES • *Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply Mains as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous lines.*

THE DESIGN OF SLUDGE DIGESTING TANKS FOR EFFICIENT GAS PRODUCTION

By ALBERT B. KOZMA
Superintendent
JOINT MEETING SEWAGE TREATMENT PLANT
RUTHERFORD, N. J.

MUCH has been written lately about efficient utilization of sludge gas in such various fields as the heating of buildings, generation of power, etc., but not much is heard about efficiency in the *production* of this gas.

In the majority of sewage plants at present more than half of the gas is used to maintain proper temperatures in the digestion tank and only the remainder is available for other purposes. It is obvious that by better heat insulation of the digestion unit more of generated gas is released for other uses. We know of some instances where not enough heat was provided to maintain sufficiently high temperatures in the tank during cold weather; as a result, foaming and other operating troubles occurred. This condition, of course, must be eliminated.

It is the purpose of this article to describe (1) how to design sludge digesting tanks with regard to effective and economical heat insulation and, therefore, more efficient and economical gas production; (2) what expedients to use if the heat supply is insufficient.

Theory of Heat Balance

Sufficient rule-of-thumb information is available to design sludge digesters surrounded with earth embankment. Modern structures which are exposed to the air, however, can not be properly designed in such manner and careful analysis is required to determine how to insulate them.

The basic relation between heat losses through the roof, walls and floor, on one hand, their structural elements, and the inside and outside temperature is as follows:

$$Q = AU = A \frac{T_i - T_o}{\frac{1}{F_i} + \frac{b}{k} + \frac{1}{f_o}} \qquad \text{(Equation 1)}$$

where (Q) is the British thermal unit per hour, (A) is the area of the wall in square feet, (T_i) is the inside temperature, (T_o) is the outside temperature, (f_i) is the surface coefficient of heat transfer to the inner surface of the tank, (f_o) is surface coefficient of heat transfer to the outer surface of the tank, (b) is the thickness of the wall in inches, (k) is the thermal conductance of a homogeneous material, 1 inch thick, expressed in BTU's per square foot of area per hour, per inch of thickness, per degree (F.) difference in temperature between the two surfaces of the material.

The Author

If the wall is composed of several layers, each with a different value of (k), the several materials are considered separately. If liquid rather than air or gas is in contact with the inside of the wall, the fraction ($1/f_i$) is omitted. The surface coefficient on either side of air spaces which are less than ½ inch in thickness is also omitted, assuming that there are no convection currents.

Coefficients of thermal conductance (k) and surface transmittance (f) are given in tables (1) and (2), respectively.

TABLE—1
Coefficients of Conductance

Material	k
Cork insulation	0.32
Wood	1.0
Air space (at 50% efficiency)	2.2
Methane saturated with water	3.0
Brickwork	4.5
Damp concrete	7.2*

*Note: In dry concrete (k) equals 5.2; 5% increase takes place for each 1% increase in the moisture content.

TABLE—2
Surface Coefficients of Transmittance

Material	f
Concrete or masonry exposed to still air	1.9*
Concrete to dry earth	1.0
Concrete to wet earth or water	2.0
Steel to air	2.0
1-in. cork insulated, built up roof	0.26
Membrane waterproofing	4.6

*Multiply this figure with 2.2 if 15 mile wind is assumed.

Heat Computations for a Specific Example

To illustrate how a heat computation is made, a specific problem will be worked out in tabulated form.

Figure 1 shows the structure, the left half section representing the design according to scheme (1), the right half section according to scheme (2).

The heat requirements consist of

(1) The heat necessary to heat up the raw, incoming sludge to tank temperature;

(2) The radiation losses.

With reference to (1), let us assume that 20,000 gallons of sludge is pumped daily, of 50 deg. F. temperature, and that the tank temperature is 80 deg. F. The amount of heat required per hour is

$Q = 20{,}000 \times 8.33 \times (80 - 50) \times 1/24$
$= 208{,}500$ BTU. per hr.

Table 3 shows the radiation losses if scheme (1) or scheme (2) is carried out. In evaluating the economies of additional insulations in scheme (2) we assumed that 10,000 BTU cost 2c. This cost has been arrived at as follows:

(a) cost of gas 60c per cu. ft. gross and assuming 60% thermal efficiency; 360 BTU net; therefore 10,000 BTU cost 1.7c.

(b) operating cost, if pumping the heating water against 10 ft. head, and the temperature difference of the feed and return wate is 20 deg. F., 1/6 KW. hr. per 10,000 BTU.'s at 1.8c equals 0.3c.

Total of (a) and (b) is 2c per 10,000 T.T.U.

The total heat requirement is—

	BTU./hr.
(1) to heat up raw sludge	208,500
(2) radiation losses, table (3) scheme (2)	78,590
Total	287,090

From the above it is apparent that considerable heat economy can be attained if a suitable heat exchanger is developed to transmit the heat of the overflowing digested sludge to the incoming raw sludge.

Hot Water Heating System

The next problem is to design a hot water heating system which can deliver the amount of heat required.

The gas boiler should have a minimum rating of 300,000 BTU per hr. In designing the heating coils the following relation holds good:

$$Q = h\,a\,(t_1 - t_2) \qquad \text{(Equation 2)}$$

where (Q) is the amount of heat transmitted, (a) is the heating coil area, (t_1) is the temperature of the heating water, (t_2) is the temperature of the sludge.

(h), the film coefficient of heat transfer, can be determined from the McAdams and Frost equation:

$$h = \frac{C}{D^{0.2}} \left[1 + \frac{50}{r}\right] \left[\frac{v}{u}\right]^{0.8} \qquad \text{(Equation 3)}$$

where (C) is a constant depending upon the particular conditions of the problem, (D) is the inside diameter of the coil in inches, (r) is the ratio of the length of the pipe coil to its diameter, (v) is the velocity of the flow in feet per second, and (μ) is the viscosity of the heating water expressed in centipoises.

At our plant we found that (C) equaled 3.73. The heating coils consist of new 3-inch chrome-nickel iron pipe, no lime or other deposits on their outside surface. To apply this equation to heating systems which have been in use for some time, we propose to reduce the value of (C) to 3.0 and the modified form of equation for our problem will be

$$h = 3.0/D^{0.2}\,(1 + 50/r)\,(v/\mu)^{0.8} \qquad \text{(Equation 3a)}$$

Using 3-inch pipe coils in our example as heating coils, 6 coils in parallel, each 125 feet long, (a) equals 670 square feet, (t_1) 130 deg. F., (t_2) 80 deg. F., (r) equals 6,500 and (μ) 0.5 centipoise.

Substituting these values in equations (2) and (3a) and solving for (v) we find that it equals 2.16 feet per second; therefore, a 44 gallon per minute, hot water circulating pump is required.

Conclusions

Table (3) brings out the fact that proper heat insulation is of equal importance with structural strength in the design of the tank. It is also evident from this table, also from table (2) that the location of the structure has a considerable effect on its heat efficiency, namely, its exposure to air and its depth under the ground water table.

Equation (3) indicates that in order to increase (h), more and smaller hot water circulating coils should be used in place of fewer and larger pipes.

Remedies in Case of Faulty Design

If the design is faulty and the operator finds that the amount of heat available is not sufficient, he has several methods at his disposal to increase the heat supply:

(a) insulation of the roof;

(b) insulation of the sidewalls if possible;

(c) increasing the capacity of the hot water circulating pump by purchasing a larger unit, or a unit of like size, placed in series or in parallel with the existing unit;

(d) adding another gas boiler unit if the existing one is insufficient, or utilizing the heat from the auxiliary burner, if one is provided, to supplement the gas burner;

(e) cutting down the amount of raw sludge pumped in, either by thickening it or disposing of it in some other way.

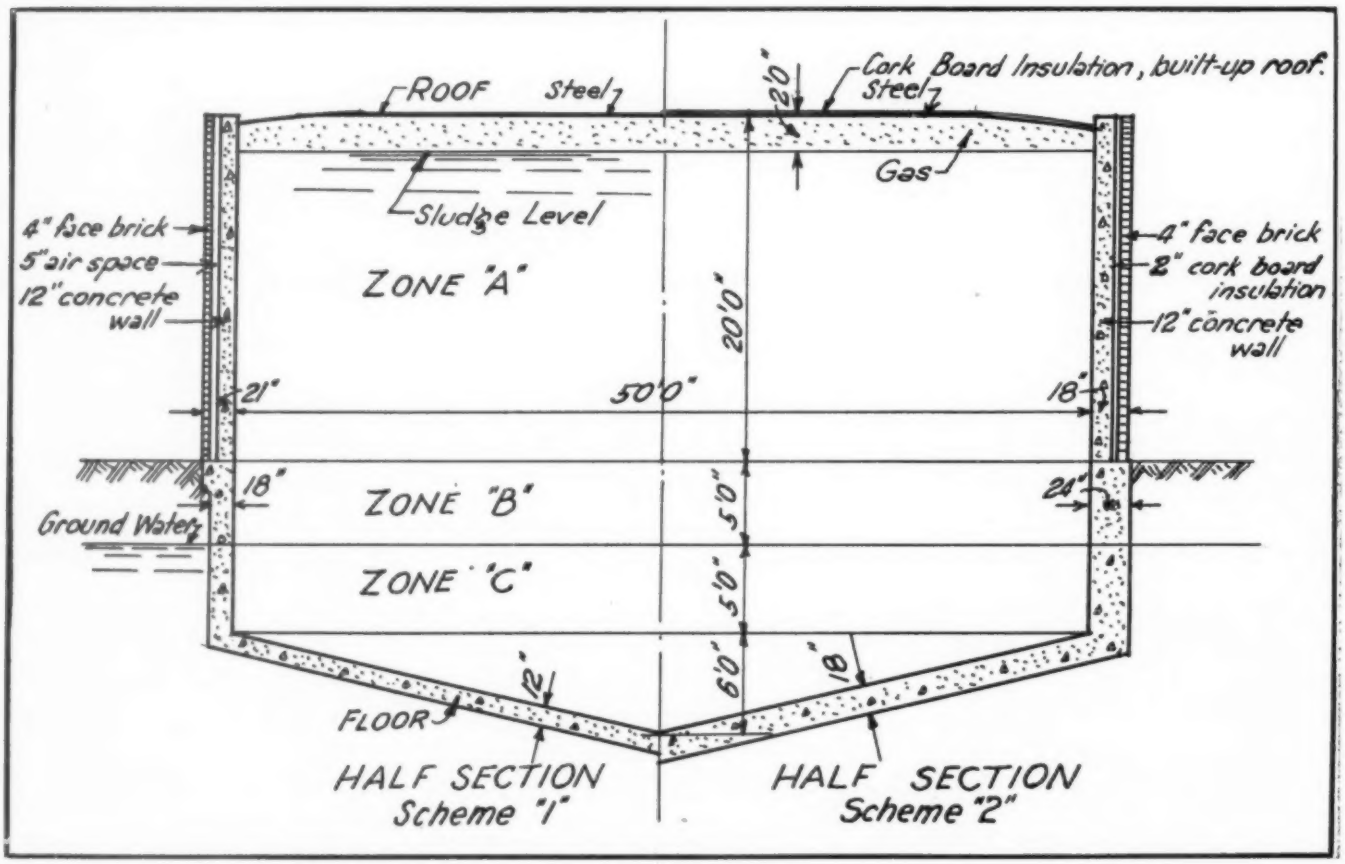


Fig. 1.—Section Through an Orthodox Digestion Tank Illustrating Good and Poor Insulation.

SECTION	AREA sq. ft.	SCHEME "1" Material	U_1 Btu/hr./sq.ft.	Q_1 Btu/hr.	SCHEME "2" Material	U_2 Btu/hr./sq.ft.	Q_2 Btu/hr.	SAVING Btu/hr.	SAVING CAPITALIZED AT 5%(*) Dollars	COST OF ADDIT'L INSULATION Dollars
Roof	1960	Steel Plate	$\frac{80-20}{\frac{24}{3.0}+\frac{1}{2}}$	13,800	Steel plate & cork board built-up roof	$\frac{80-20}{\frac{24}{3.0}+\frac{1}{0.26}}$	9950	3850	1356	980
Zone "A"	3250	12" concrete 5" air space 4" face brick	$\frac{80-20}{\frac{12}{7.9}+2\times\frac{1}{1.9}+\frac{5}{2.2}+\frac{4}{4.5}+\frac{1}{4.2}}$	32,700	12" concrete 2" cork board 4" face brick	$\frac{80-20}{\frac{12}{7.9}+\frac{2}{0.32}+\frac{4}{4.5}+\frac{1}{4.2}}$	21,900	10,800	3800	1430
Zone "B"	812	18" concrete	$\frac{80-40}{\frac{18}{7.9}+1}$	9900	24" concrete	$\frac{80-40}{\frac{24}{7.9}+1}$	8040	1860	652	300 (**)
Zone "C"	812	18" concrete	$\frac{80-40}{\frac{18}{7.9}+\frac{1}{2}}$	11,700	24" concrete	$\frac{80-40}{\frac{24}{7.9}+\frac{1}{2}}$	9200	2500	872	300 (**)
Floor	2060	12" concrete	$\frac{80-40}{\frac{12}{7.9}+\frac{1}{2}}$	40,800	18" concrete	$\frac{80-40}{\frac{18}{7.9}+\frac{1}{2}}$	29,500	11,300	3970	760 (**)
TOTAL	8894			108,900			78,590	30,310	10,650	3770

NOTES: (*) Based on 10,000 Btu-s costing 2 ¢
(**) Concrete at $20.00 per cu.yd.

TABLE 3
Computation Values in Figuring Radiation Losses

Summary

In concluding this article we want to point out that it is not sufficient to design a digestion tank structurally adequate; it is equally important that it is so built that it conserves all the heat possible within the bounds of sound economy. It is further important that an adequate heating plant be provided to produce sufficient heat for proper sludge digestion.

If all these requirements are fulfilled, more gas will be available for power and heat or some other purposes and the operator will not be forced to resort to emergency or makeshift methods to overcome operating difficulties.

UNIQUE PIPE JOINTING

Involves Calking from the Inside of Metal Poured from the Outside

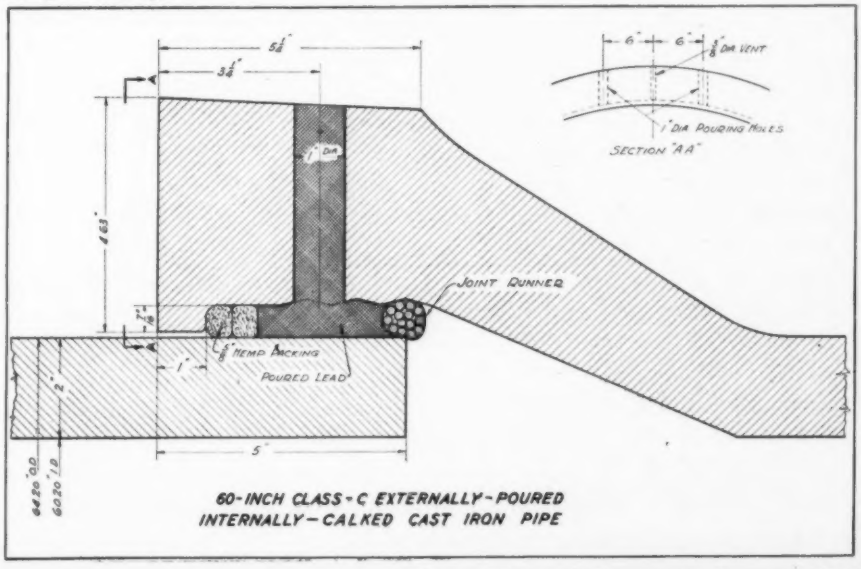
THE accompanying sketch illustrates something new in pipe jointing which has definite advantages when used on mains of size that can be entered by a calker.

Concerning this internally calked joint, an article in U. S. Pipe & Foundry Co.'s *U. S. Piper* has the following to say:

"This type of joint for pipe large enough to permit a man to enter and calk can be advantageously used to meet special or unusual installation conditions. As shown in the accompanying cross-sectional drawing of the joint assembly, the spigot end is plain and does *not* seat against the back of the bell. These features permit sufficient longitudinal movement to relieve expansion and contraction stresses due to temperature changes.

This joint has been used where the pipe must run between existing structures with such limited clearance that it would be impossible to make up an externally calked joint. Another use was for a 60-inch line over which a heavily reinforced concrete floor was to be poured. It was felt advisable to use an internally calked joint so that it could be recalked by dewatering the line rather than breaking through the heavy expensive floor slab in case some joint leakage developed."

We have seen a number of pipe installations where this type of jointing would have made for space conservation and are reproducing the line drawing from *The U. S. Piper*, believing that the internal caulking method can prove a decided economy measure.



60-INCH CLASS-C EXTERNALLY-POURED INTERNALLY-CALKED CAST IRON PIPE

OPERATING LOG FOR A SMALL SEWAGE PLANT

By A. A. HIRSCH
State Department of Education
BATON ROUGE, LOUISIANA

THE desirability of complete record keeping about a sewage plant is generally recognized but operating logs are often so bulky, and time consuming to attend, that operators frequently regard them with disfavor. A properly planned log should contain only pertinent and useful data; its form should be streamlined to expedite the recording of necessary figures. Excessive use of columns to record other than regularly recurrent data should be avoided. Aids should be included for easy reference to records of previous periods.

The application of these principles to the design of a daily operating report for a small plant providing primary settling in an Imhoff Tank and secondary trickling filter treatment is illustrated in the accompanying drawing. Obviously the information carried and form best adapted will vary with the size and type of plant; however, the essential points as enumerated below can always be employed to advantage. In the illustrated log will be noted columns for customary daily data; a sheet covers a month's operation. As in many plants, the blanks are printed in different colors for duplicates or triplicates, with stiff cover binding. Groups of related data are separated by heavy vertical ruling; every fifth date line is also drawn heavy to facilitate space location. The column headings are all self explanatory, excepting the codes, which will be discussed below. Mechanical and operational data are segregated from the chemical test results. Customary rulings appear at the bottom of the sheet for the monthly summary. A liberal width is reserved in the remarks column for infrequent details or a condensed diary. Additional notes of this character can be written on the back of the sheet with proper reference on the corresponding date line. The extra column, preceding the "Remarks" column (now blank), is provided for possible future need.

Distinctive Features

It is to the following five features, some of them unique, that attention is specifically directed:

1. *Size of Sheet.* The sheet measures 11 by 16⅝ inches. This is a convenient size, its length being the same as that of an ordinary letter size typewriter sheet, while its width is slightly less than double a letter sheet. Records detached from the blank book may be folded slightly beyond the middle to fit a file folder exactly as would a letter. Using the same crease, the left margin extends out as a single thickness almost the full ruled width, thereby permitting perforation to fit ordinary size loose-leaf binders.

2. *Double Date Column.* Date columns are printed at both sides of the tabulated data in order to locate particular date spaces by easy glances and with less chance for error.

3. *Coding.* All routine descriptive remarks are keyed to condense this information. The identity and sequence of units in service are recorded by code in the proper column. Points of chlorine application are denoted by a key letter placed behind the total quantity used. A suitable legend explaining the code is placed off to the right of the sheet so that the information will always be intelligible. By way of example, the notation in the units in use column T2E-R1-F2 would signify on that date Imhoff tank No. 2 flowed eastward and rotary filter No. 1 with final settling tank No. 2 were in service. In the chlorine quantity per day column the data 5.5-EF would mean that this weight of chlorine, in pounds, was being divided between the Imhoff effluent and the final settling tank.

4. *Occasional Information Boxed Separately.* Infrequent data are posted in a side space to conserve room in the main tabulations, where this type of information would be difficult to locate. A special tabulation is made to the right of the sheet to record sludge drawoffs. Service connections also are displayed in an individual box.

5. *Marginal Indexing.* Marginal tabs for quick location of past records in bound volumes of monthly sheets is provided by printing the edge of the sheet with names of the months. In use, all other names except for the month concerned are cut off. If the sheet is folded during filing, the operator may print the name of the month on the reverse of the tab also.

A log of this type is presently giving satisfaction at the Rayne, La., disposal plant, where Mr. E. J. Bertrand is superintendent, and Mr. Pat Spell, operator. With functionally arranged sheets, record keeping is expedited and the value of previous logs for reference is enhanced.

SMALLTOWN, LOUISIANA

SEWAGE TREATMENT PLANT OPERATING REPORT

MONTH OF _____ 194__

Date	Sewage Flow MGD	POWER: Reading KWHr	POWER: Consmpn KWHr	UNITS IN USE (CODE)	TEMP. °F: Air	TEMP. °F: Sewage	Rainfall in.	SETTLEABLE SOLIDS ml/L: Raw	SETTLEABLE SOLIDS ml/L: Settled	SETTLEABLE SOLIDS ml/L: Final	SETTLEABLE SOLIDS ml/L: % Removd	pH: Raw	pH: Settled	pH: Final	pH: Sludge	Relative Stability %	CHLORINE: Cylindr Weight Setting	CHLORINE: Quantity #/Day	CHLORINE: Points Applied	CHLORINE: Dose p.p.m.	CHLORINE: Residual p.p.m.
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2																					
3																					
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30																					
31																					
TOT.																					
Avg.																					
Max.																					
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Date	REMARKS
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TOT.	
Avg.	
Max.	
Min.	

SLUDGE WITHDRAWLS

Date	Imhoff Tank No.	Amount Cu. Ft.

Service Connections at End of Month

CODES

Plant Units
T - Imhoff Tank - 1-2
Flow - (E)ast-(W)est
R - Rotary Filter - 1-2
F - Final Set. Tank - 1-2

Chlorine Points
R - Raw Sewage
E - Imhoff Effluent
F - Final Set. Tank

OPERATOR _____

SUPERINTENDENT _____

JAN. | FEB. | MAR. | APR. | MAY | JUNE | JULY | AUG. | SEPT. | OCT. | NOV. | DEC.

Operating Log for Small Sewage Plants

ALKALINITY EQUIVALENTS

AMONG the mineral compounds present in natural waters, Calcium Carbonate is the most ubiquitous. Partly for this reason and partly because its molecular weight, at the time, was thought to be exactly 100, this compound was chosen as the standard to be employed in the measurement of alkalinity and hardness.

With more accurate determination of atomic weights, the molecular weight of Calcium Carbonate is now assumed to be 100.08. Very obviously, tables earlier prepared under the assumption that the molecular weight was 100, will have a small and not entirely negligible error, if the true weight be 100.08. The accompanying table, based upon the newer molecular weight of 100.08 for Calcium Carbonate are arranged in such manner as to facilitate comparisons against other substances having different values of alkalinity. These values are presented as being more accurate than those appearing in earlier tables computed on the old 100 molecular weight value assumed for Calcium Carbonate.

A brief explanation of how the tables may be used follows.

In the sixth column, sixth line, the unity of Calcium Carbonate may be compared directly against every other factor in the column. For instance, one part of alkalinity, due to Calcium Carbonate, is the exact equivalent, in alkalinity value, to that which would be imparted by 1.6196 of Calcium Bicarbonate; 0.7403 of Calcium Hydroxide; 0.8424 of Magnesium Carbonate; 1.0590 of Sodium Carbonate (dehydrated), etc.

Along the line, right or left, a different comparison may be made. The molecular weight, for instance, of Calcium Bicarbonate, is in excess of that of Calcium Carbonate. Therefore, it takes more Calcium Bicarbonate to produce a given alkalinity than it does of Calcium Carbonate, and it is found that for an equal weight of Calcium Bicarbonate the alkalinity value as compared against Calcium Carbonate is only 0.6174 parts. On the other side an equal weight of Calcium Hydrate will have an alkalinity value of 1.3506 parts; Sodium Hydroxide 1.2508—and so on.

From the foregoing it is seen that the compounds in these tables may be compared in two different ways against the Calcium Carbonate Standard for alkalinity, or against any other compound in the table. For instance, under the heading Sodium Hydroxide (NaOH) it is noted that one part is equal in alkalinity value to 1.3247 parts of Sodium Carbonate (Soda Ash); and, further, that one part of Sodium Carbonate is only equal to 0.9442 parts of Calcium Carbonate in raising alkalinity values.

ALKALINITY EQUIVALENTS*

Compound	Formula	$Al_2(OH)_6$	BaO	$Ba(OH)_2$	CaO	$Ca(OH)_2$	$CaCO_3$	$CaH_2(CO_3)_2$	MgO	$Mg(OH)_2$
Aluminum Hydrate	$Al_2(OH)_6$	*1.0000*	0.3390	0.3034	0.9271	0.7017	0.5195	0.3207	1.2895	0.8913
Barium Oxide	BaO	2.9494	*1.0000*	0.8948	2.7734	2.0697	1.5323	0.9461	3.8035	2.6289
Barium Hydrate	$Ba(OH)_2$	3.2959	1.1174	*1.0000*	3.0559	2.3128	1.7123	1.0572	4.2503	2.9377
Calcium Oxide	CaO	1.0785	0.3656	0.3272	*1.0000*	0.7568	0.5603	0.3459	1.3908	0.9613
Calcium Hydrate	$Ca(OH)_2$	1.4250	0.4831	0.4323	1.3212	*1.0000*	0.7403	0.4571	1.8376	1.2701
Calcium Carbonate	$CaCO_3$	1.9247	0.6525	0.5839	1.7845	1.3506	*1.0000*	0.6174	2.4821	1.7155
Calcium BiCarbonate	$CaH_2(CO_3)_2$	3.1174	1.0569	0.9458	2.8904	2.1876	1.6196	*1.0000*	4.0202	2.7786
Magnesium Oxide	MgO	0.7754	0.2629	0.2352	0.7189	0.5441	0.4028	0.2487	*1.0000*	0.6911
Magnesium Hydrate	$Mg(OH)_2$	1.1219	0.3803	0.3403	1.0402	0.7873	0.5828	0.3598	1.4468	*1.0000*
Magnesium Carbonate	$MgCO_3$	1.6216	0.5498	0.4920	1.5035	1.1379	0.8425	0.5201	2.0912	1.4454
Magnesium BiCarbonate	$MgH_2(CO_3)_2$	2.8143	0.9541	0.8538	2.6094	1.9749	1.4621	0.9027	3.6293	2.5085
Sodium Oxide	Na_2O	1.1922	0.4042	0.3617	1.1054	0.8366	0.6194	0.3824	1.5375	1.0627
Sodium Hydrate	NaOH	1.5387	0.5217	0.4668	1.4267	1.0798	0.7994	0.4935	1.9843	1.3715
Sodium Carbonate	Na_2CO_3	2.0385	0.6911	0.6184	1.8900	1.4305	1.0590	0.6538	2.6288	1.8169
Sodium Carbonate, Hydrated	$NaCO_3,10H_2O$	5.5033	1.8658	1.6697	5.1025	3.8619	2.8592	1.7653	7.0969	4.9052
Sodium BiCarbonate	$NaHCO_3$	3.2312	1.0955	0.9803	2.9958	2.2674	1.6787	1.0364	4.1669	2.8800
*Tri-Sodium Phosphate	Na_3PO_4	2.1028	0.7129	0.6380	1.9497	1.4756	1.0925	0.6745	2.7118	1.8743
Tri-Sodium Phosphate, Hydrated	$Na_3PO_4,12H_2O$	4.8747	1.6527	1.4790	4.5197	3.4207	2.5326	1.5636	6.2863	4.3449

Compound	Formula	$MgCO_3$	$(CO_3)_2$	Na_2O	NaOH	Na_2CO_3	Na_2CO_3, $10H_2O$	$NaHCO_3$	Na_3PO_4	Na_3PO_4 $12H_2O$
Aluminum Hydrate	$Al_2(OH)_6$	0.6166	0.3553	0.8387	0.6498	0.4905	0.1817	0.3094	0.4755	0.2151
Barium Oxide	BaO	1.8187	1.0480	2.4737	1.9167	1.4468	0.5359	0.9128	1.4025	0.6050
Barium Hydrate	$Ba(OH)_2$	2.0324	1.1711	2.7643	2.1419	1.6168	0.5989	1.0200	1.5672	0.6761
Calcium Oxide	CaO	0.6650	0.3832	0.9046	0.7009	0.5290	0.1959	0.3337	0.5128	0.2212
Calcium Hydrate	$Ca(OH)_2$	0.8787	0.5063	1.1952	0.9260	0.6990	0.2589	0.4410	0.6776	0.2923
Calcium Carbonate	$CaCO_3$	1.1869	0.6839	1.6143	1.2508	0.9442	0.3497	0.5956	0.9152	0.3948
Calcium BiCarbonate	$CaH_2(CO_3)_2$	1.9223	1.1076	2.6146	2.0259	1.5292	0.5664	0.9647	1.4824	0.6395
Magnesium Oxide	MgO	0.4781	0.2755	0.6503	0.5039	0.3803	0.1409	0.2399	0.3687	0.1590
Magnesium Hydrate	$Mg(OH)_2$	0.6918	0.3986	0.9409	0.7291	0.5503	0.2038	0.3472	0.5334	0.2301
Magnesium Carbonate	$MgCO_3$	*1.0000*	0.5762	1.3601	1.0538	0.7955	0.2946	0.5018	0.7711	0.3326
Magnesium BiCarbonate	$MgH_2(CO_3)_2$	1.7354	*1.0000*	2.3604	1.8289	1.3806	0.5113	0.8709	1.3382	0.5773
Sodium Oxide	Na_2O	0.7352	0.4236	*1.0000*	0.7748	0.5848	0.2166	0.3689	0.5669	0.2445
Sodium Hydrate	NaOH	0.9488	0.5467	1.2906	*1.0000*	0.7548	0.2796	0.4762	0.7317	0.3156
Sodium Carbonate	Na_2CO_3	1.2570	0.7243	1.7097	1.3247	*1.0000*	0.3704	0.6308	0.9693	0.4181
Sodium Carbonate, Hydrated	$NaCO_3,10H_2O$	3.3936	1.9554	4.6157	3.5764	2.6996	*1.0000*	1.7031	2.6169	1.1289
Sodium BiCarbonate	$NaHCO_3$	1.9925	1.1481	2.7100	2.0998	1.3850	0.5871	*1.0000*	1.5364	0.6628
Tri-Sodium Phosphate	Na_3PO_4	1.2967	0.7471	1.7637	1.3665	1.0315	0.3821	0.6504	*1.0000*	0.4313
Tri-Sodium Phosphate, Hydrated	$Na_3PO_4,12H_2O$	3.0059	1.7320	4.0885	3.1679	2.3913	0.8857	1.5078	2.3181	*1.0000*

*An unpublished table prepared by the late C. Arthur Brown, of Lorain, Ohio.

THE "OXIDATION INDEX"

As an Element of Process Control*

By EDWARD B. MALLORY
Director
LANCASTER RESEARCH LABORATORIES*
HACKENSACK, N. J.

The Author
(To satisfy the cameraman he figured an "Index")

IN AN earlier paper which appeared in the August, 1941 issue of WATER WORKS AND SEWERAGE the writer made an attempt to present the various controlling elements in the "Oxidized Sludge Process." This paper evoked comment from the four corners of the globe, but strangely, some engineers in charge of the larger of our activated sludge plants expressed the opinion that the elements of control had not been defined in sufficient detail to prove adequately instructive or sufficiently useful. In consequence, this paper, prepared at the suggestion of the Editor of WATER WORKS AND SEWERAGE, constitutes an attempt to more fully explain what the writer has designated as the "Oxidation Index," and its application as an element of process control in activated sludge plant operation.

When extended an invitation to address you, your program committee suggested that I discuss the subject of "Control of the Oxidized Sludge Process." This suggestion was particularly welcome, in view of the circumstances recited. In a further attempt to convey a knowledge of the various elements of the Oxidized Sludge Process, I have been planning to deal individually with each of the elements of control as opportunities are presented. It is, therefore, opportune to discuss here the first and possibly the most important of these elements, the evaluation of sludge condition, and to explore its ramifications and to outline the simplicity of applying comprehensive test methods in daily practice.

When a modern imposing edifice similar to the Empire State Building is erected, it is first necessary to tear down the existing structures. This demolition in no wise reflects on the abilities of the architects who designed and erected them as they undoubtedly represented the latest developments in the art at the time they were built. In a somewhat similar manner, it is often necessary to tear down existing beliefs and prejudices before more advanced knowledge may be assimilated and incorporated in practical developments.

What Is the "Oxidized Sludge Process"?

It has long been my opinion, and I think I have definitely established it in practice, that the aeration sedimentation treatment cycle, commonly known as the Activated Sludge Process, is in fact an extremely simple mechanism. Contrary to current belief, I regard it as essentially an *oxidation process, rather than a predominantly biological process,* and that the principal element is a physico-chemical mechanism in which the animal inclusions, admittedly present in billions, play only a minor part under proper operating conditions. As a matter of fact, when the animal inclusions do begin to play a predominant part, conditions are far from proper. Accordingly, I prefer to call this type of treatment cycle, when properly controlled, an "Oxidized Sludge Process."

In this physico-chemical mechanism, sludge is the principal factor. Sludge may be defined as a conglomeration of countless particles of countless identities of mineral, vegetable and animal origin, dispersed in a water phase. It can be demonstrated that the volatile constituents may be completely consumed by eremacausis if the aeration is prolonged to sufficient degree, leaving as a residue the fixed or inert particles. In the treatment of wastes we are concerned with the reduction or removal of the unstable elements in the shortest time and with a minimum expenditure of energy. We may, therefore, limit the processing of wastes to the oxidation of the dissolved unstable constituents and the mechanical removal of the suspended unstable or incompletely oxidized constituents. These will be precipitated, when oxidized to sufficient degree, and excess quantities may be removed with the non-expendable fixed component. A sensible portion of raw or partly oxidized particles may also be precipitated by adsorption on, or agglomeration with, the more highly oxidized particles.

The optimum condition of balance, or aggregation oxidation and precipitation coincides with the maximum degree of clarification and purification of the liquid phase. As this is a physical balance it is logical to consider that a mechanism of this character will respond to physical laws and that measurements to evaluate its potentialities as a mass agency may be devised. Unless and until we employ such measurements, we cannot expect to process sewage, a most complicated and constantly variable raw material, with any degree of uniformity and reliability. This ratiocination has opened up broad fields of study and practical development, obscured to the ecologist, or others concentrating on a study of the love life of the multitude of individual animal breeds or the reactions between each of the myriad of chemical constituents.

Diversity of Opinion and Uncertainty Seems Unfortunate

Early in the pursuit of studies consonant with this reasoning, at existing activated sludge treatment plants, it became evident that much uncertainty and diversity of opinion

*This paper, written for "WATER WORKS AND SEWERAGE," was presented by the author before the Michigan Sewage Works Operator's Association.

*Division of Lancaster Iron Works, Inc., Lancaster, Pa.

existed, in regard to the causes of the aperiodic, and in many instances frequent and protracted, failure of the process to deliver a highly clarified and purified effluent. Probably the most prevalent cause of failure and the greatest element of uncertainty in the mind of the activated sludge plant operator is sludge bulking. Numerous theories have been advanced to explain this alleged phenomenon, and numerous indices have been proposed in attempts to provide a measurable knowledge of sludge conditions.

The most recently proposed and widely used index of sludge condition is the one reported by Mohlman in January, 1934. In presenting this index, Mohlman reviewed the indices previously proposed by Wagenhals, Theriault and Hommann reported in U. S. Public Health Bulletin No. 132, published in 1924, the Donaldson Index published in January, 1932, and the Hazeltine Index published in May, 1932. Commenting on these earlier indices, Mohlman stated:

> "In all these computations the weight of sludge solids, in parts per million, has been in the numerator. This means that bulking sludge is expressed by a diminishing numerical index. This has seemed to some investigators to be inconsistent with the concept of bulking, consequently they have turned the equation upside down and placed the results of the settling test in the numerator, thus giving an increased numerical index for bulking sludge."

This index is described as,

> "The volume in cubic centimeters occupied by one gram of sludge after settling 30 minutes"—and—is computed by dividing the result of the settling test, in per cent, by the result of the determination of suspended solids, also in per cent."

It was further stated that sludge which exhibited an index of 40 by this method of measurement was regarded as "rapidly settling sludge" and that an index of 200 indicated "slowly settling or bulking sludge." This method of measurement presupposes an uniformity in the ratio of weight to settling characteristics of the sludge in all treatment plants under bulking conditions. The error in this premise will be demonstrated graphically a little later. More particularly, this method fails to stipulate an optimum value. This index was proposed as consistent with the concept of sludge bulking and "giving an increased numerical index to bulking sludge." The earlier indices mentioned were devised to give an increasing numerical index to sludge of increasingly better quality, and therefore, each of these could be properly termed a "Sludge Index," generally abbreviated "S.I." Accepting the distinction by definition, as prescribed by Mohlman, it seems equally appropriate to characterize his index as a "Bulking Index" or by convenient abbreviation, "B.I."

In the paper previously mentioned, I stated that "bulking is man made." It is in no sense a phenomenon, nor an uncertainty. "Bulking" defines a simple physical condition of sludge which can be created or avoided with equal ease. It is the manifestation of a disregard of the optimum condition of balance above recited. These observations being so, it is obvious that bulking may be completely eliminated from the consideration of the operator, but this cannot be done however, by any method of measurement or control expressed in general or vague terms.

To avoid any misinterpretation let me say that my idea of controlling a treatment process is by no means limited to avoiding bulking. Even a proximity to bulking can be unknown in properly designed and controlled plants. The "Oxidized Sludge Process" is capable of delivering an effluent representing a B.O.D. and suspended solids reduction efficiency of 99%. It had been adequately shown that this degree of clarification and purification can be maintained reliably and consistently, by proper process control.

The average municipal treatment plant represents a relatively large investment, particularly those of the activated sludge type. Unless this type of plant is operated at its maximum efficiency and the community receives benefits consonant with the investment, an economic loss is represented. The treatment works superintendent or operator who consistently maintains the efficiency of his plant in the neighborhood of 99% becomes an important figure in the community and a man entitled to the respect and support of all its citizens.

Knowing Sludge Condition a Most Important Element

One of the most important elements or requirements in the operation of the Oxidized Sludge Process is a practical means of determining at will, the relationship between the condition of the principal mechanism in the process, the sludge, and the optimum sludge condition. This immediately requires a knowledge of, or means of determining, the optimum condition. I think you will agree, that heretofore no one has given us an accurate, numerically evaluated basis of determining when sludge is in an optimum condition. It is also necessary to have a simple, reliable, and quickly determined means of measuring the observed condition at the time of test, and to be able to express the observed condition in numerical values which can be compared to the optimum value. Thereby, the operator can tell whether his sludge is better or worse than the desired optimum, and to what measurable degree. I will undertake to show how you may determine a measure of both the optimum sludge condition in any particular Activated Sludge plant, and the relative condition of the sludge at any time.

Extended studies during the past ten years have confirmed the belief that optimum sludge conditions in an Oxidized Sludge Process may be determined by relating certain treatment plant characteristics and certain sludge characteristics. It is evident therefore, that optimum sludge conditions will vary at different plants. In a paper recently presented before the Sanitation Division of the American Society of Mechanical Engineers (see "Water Works and Sewerage" for August, 1942) I enunciated two broad principles:

1.—"The settling rate of Oxidized Sludge in mixed liquor is a function of the degree of oxidation of the sludge."
2.—"The capacity of the Oxidized Sludge Process to accommodate loadings is a function of the amount and degree of oxidation of the sludge."

These broad principles were supplemented by more specific principles which could be numerically evaluated.

Parenthetically, it should be remarked, that it is frequently necessary to compensate for the effect of extraneous factors which may influence test results, when exploring many physical and chemical mechanisms. For example, when testing the settling rate of oxidized sludge, absolute quiescence is difficult to create in a specimen of mixed liquor poured into a settling cylinder until after a period of several minutes, thereby masking the true physical, chemical and biological conditions of change which begin to occur at the instant the sludge is removed from the influence of the aerator, for example, synartesis. This rapidity of physical and chemical change requires that mixed liquor be subjected to the settling test as quickly as possible after removal from the aerator. As in many other studies of physical and chemical mechanisms, it has been found that a region exists which is relatively free from extraneous in-

fluences, and where the reactions occur at characteristic rates. Both mechanical and chemical factors become increasingly influential as the test progresses beyond this region, such as compacting and gasification. These again cause distortion of the true facts.

In the sludge settling test this undistorted region may be found in the period from about five minutes to about sixty minutes after settling has commenced. It has been found that during this period, and under optimum performance conditions, certain characteristic reactions follow a straight line rate of progress from the datum point. This establishes an uniform reference basis which coincides with optimum conditions at any plant. Since things equal to the same thing are equal to each other, we may properly adopt values occurring on this straight line as optimum values. Research and the reports of studies of activated sludge characteristics in the past have been seriously circumscribed for want of a reliable common reference basis. Since the discovery of the straight line concentration theory, much work has been done, but much more should be done.

Some years ago Professor Fair and his associates at Harvard University published a report of some very comprehensive studies on the subject of bound water in sludge, but these studies were largely directed to digested sludge. Oxidized sludge, to an even greater extent, exhibits characteristics involving the associated water in its various forms, that is, interstitial or free water, adsorbed water, absorbed water and the water of formation. I am hopeful that Professor Fair will undertake similar studies with respect to oxidized sludge, and that he will correlate the condition of the sludge specimens examined with the basis of reference herein reported, to the end that plant operators may compare reported data with conditions found in their plants, on a common basis. The adoption of a logical common reference basis by investigators, will also avoid the wide disparity of results so evident in the technical reports of the past. It is reasonable to believe that such studies will confirm our present thought, that it may be more nearly consistent with fact to consider that the mechanism of sludge settling is in fact dependent upon the release or expression of the water in its various forms, and that the rate at which the water is expressed is related to the degree of oxidation of the aggregation of unit particles.

Some Specific Principles

Predicated on these findings, the following specific principles may be enunciated and evaluated:

3.—Oxidized Sludge of optimum characteristics in mixed liquor taken from any given treatment cycle, will settle in one hour, in a standard two liter "Settlometer" to a volume determined by the ratio,—

$$S = \frac{1000}{K}$$

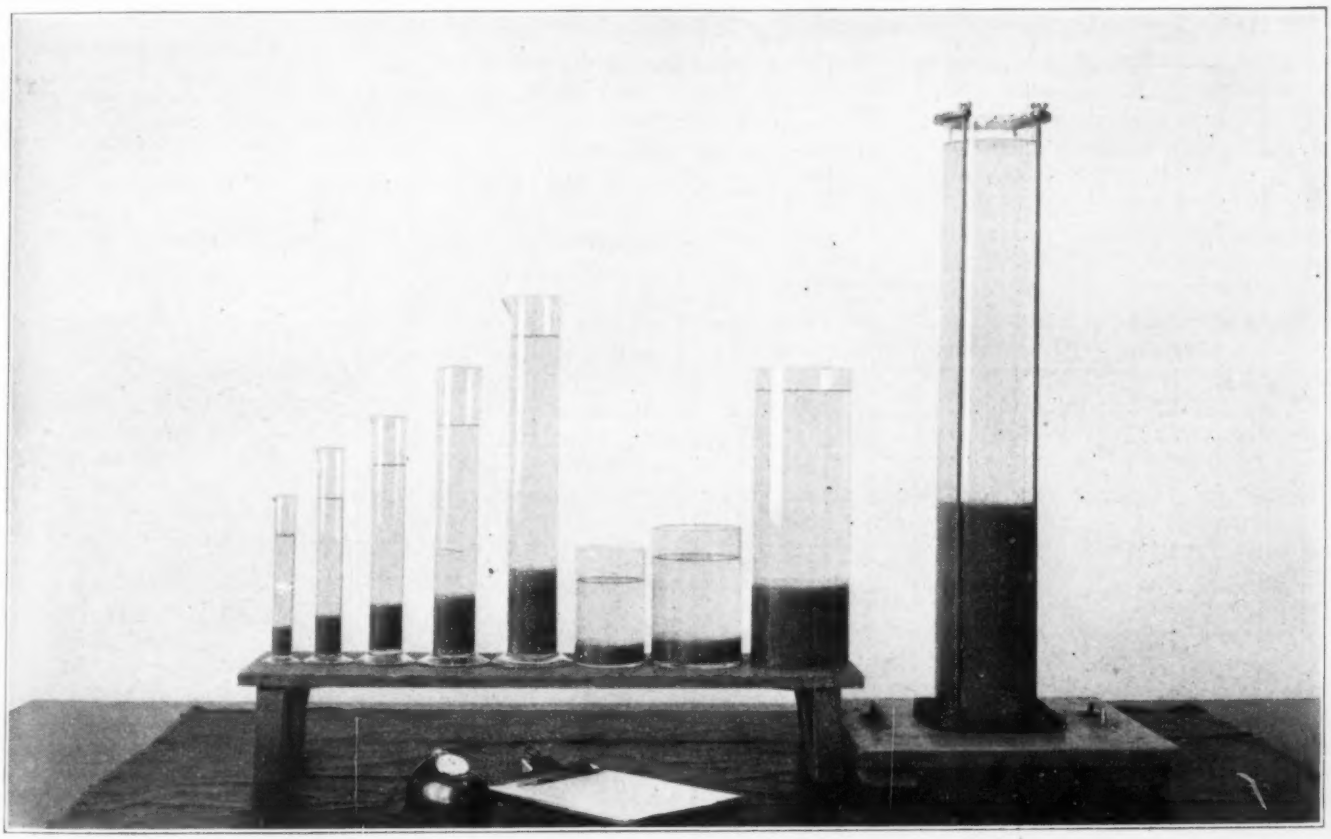
Wherein S = Sludge volume in CC/liter.
K = A treatment cycle constant, $\frac{2A}{C} - 1$, in which, A = effective aeration period in hours and, C = effective sedimentation period in hours.

4.—Oxidized Sludge of optimum characteristics in mixed liquor taken from any given treatment cycle, after settling for one hour in a standard two liter "Settlometer," will exhibit a concentration determined by the ratio,—

$$R = MK$$

Wherein M = Mixed liquor suspended solids concentration in per cent, by standard centrifuge test
R = Settled sludge suspended solids concentration in per cent, by standard centrifuge test.

5.—Oxidized sludge of optimum characteristics in mixed liquor taken from any given treatment cycle, when settled in a standard two liter "Settlometer," will exhibit a straight



The Sludge Density and Settling Rate Test

A comparison between standard narrow wall laboratory cylinders commonly employed, and the more general settling area "Settlometers" (on left) used in determining the "Oxidation Index" of activated "Oxidized Sludges."

line concentration rate during a one hour settling period.
This may be formulated,—

$$R = \frac{T}{E}(MK - M) + M$$

Or in terms of plant characteristics,—

$$R = \frac{2AT - 2CT + EC}{EC}$$

Wherein T = Observed time in minutes
E = A constant, 60

6.—Oxidized Sludge of optimum characteristics, in mixed liquor of any concentration, taken from any given treatment cycle, when settled in a standard two liter "Settlometer," will exhibit a settling rate during a one hour settling period, according to the formula,—

$$S = \frac{1000\ M}{\frac{T}{E}(MK - M) + M}$$

Or in terms of plant characteristics,—

$$S = \frac{1000\ EC}{2AT - 2CT + EC}$$

7.—The "Oxidation Index" may be determined by the simple equation,—

$$\text{"Oxidation Index" in \%} = \frac{100000}{SK}$$

Which, in effect, is the ratio of the observed sludge concentration after settling 60 minutes to the optimum 60 minute concentration. Obviously, the value at optimum coincides with the distinctly American expression of perfection—100%.

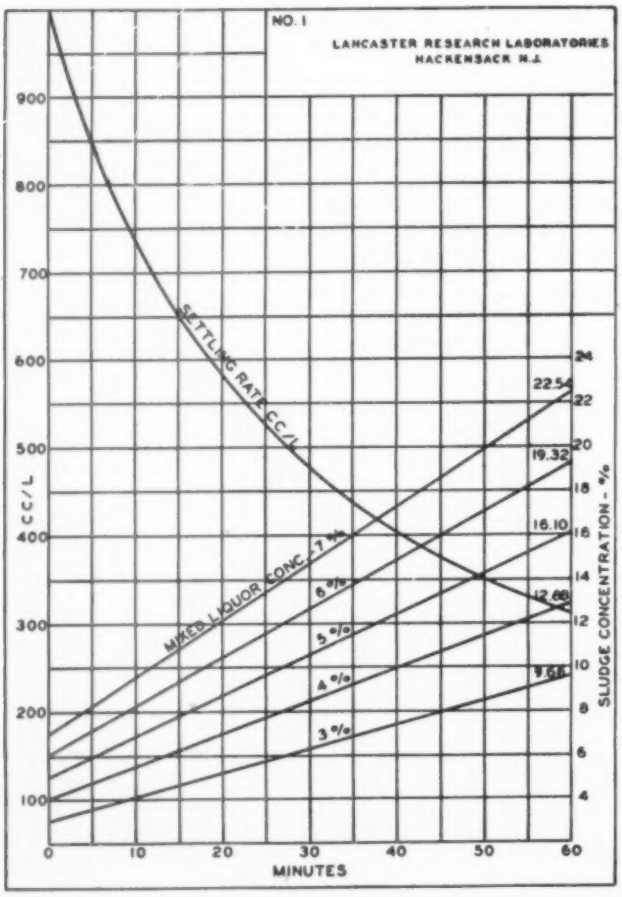
For ready reference the ratio $\frac{100000}{K}$ may be computed once and for all at any particular plant, and this constant divided by the settling in CC/L to find the "Oxidation Index."

For example, in a plant having a 3:1 aetation-sedimentation ratio, the factor K would be 2 x 3 — 1 = 5.0. Then $\frac{100000}{5} = 20000$. At a settling of 200 CC/L in 60 minutes the "Oxidation Index" would be $\frac{20000}{200} =$ 100% or optimum.

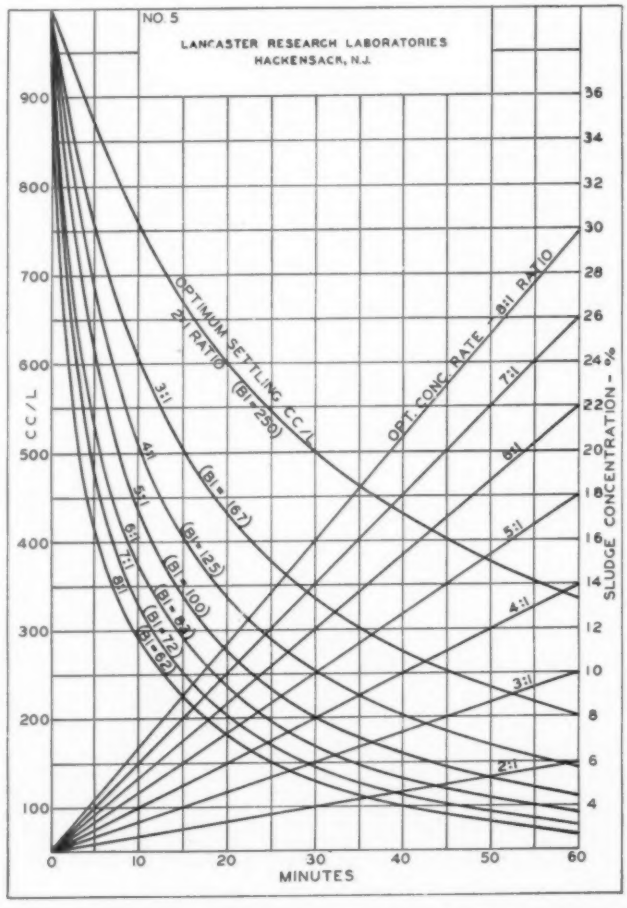
If the settling at 60 minutes was 400 CC/L the "Oxidation Index" would be $\frac{20000}{400} = 50\%$, or an indication that the sludge was bulky and that bulking was not too remote and that corrective measures should be adopted to prevent it, on the theory that an ounce of prevention costs less than a pound of cure.

On the other hand, if the settling in 60 minutes was 100 CC/L the "Oxidation Index" would be $\frac{20000}{100}$ = 200%. If the clarifier showed some turbidity this would explain it and possibly suggest the advisability of reducing the over-oxidized condition of the sludge. Accepting the validity of these principles, it follows that sludge in an optimum condition, in any treatment works, at any concentration, will exhibit a settling rate consonant with the plant characteristics stipulated.

Graph No. 1 illustrates the optimum settling rate of sludge in a treatment works having a 2.11:1 aeration-sedimentation ratio. There is included a family of concentration curves, all of which are correlated with the optimum settling rate curve. The mixed liquor and sludge concentrations exhibited in the various graphs presented evaluated in percentage, relate to tests by the approved centrifuge method. They may also be interpreted as thousands of parts per million, that is, a value of three per cent may be regarded as a concentration of 3,000 ppm., 4% a concentration of 4,000 ppm., and so on.



Graph 1—Optimum Sludge Settling and Concentration Curves Derived for a Plant Successfully Treating Milk Wastes



Graph 5—A Family of Optimum Settling and Concentration Curves—for Various Operating or Design Conditions

This graph illustrates clearly and in a simple manner, I believe, the principle expressed in Equation No. 6. It will be seen that the optimum settling rate remains uniform in any given plant regardless of the mixed liquor concentration. It will also be clear that the slope of the concentration curve is, in each instance, uniformly related to the optimum settling curve as defined by the equation $R = \frac{1000\ M}{S}$.

Graph No. 5 presents a family of optimum settling and concentration curves computed with the aid of the formulae hereinbefore recited. It is the purpose of this graph to illustrate typical modifications in the slope of the optimum settling curve responsive to varying treatment plant characteristics.

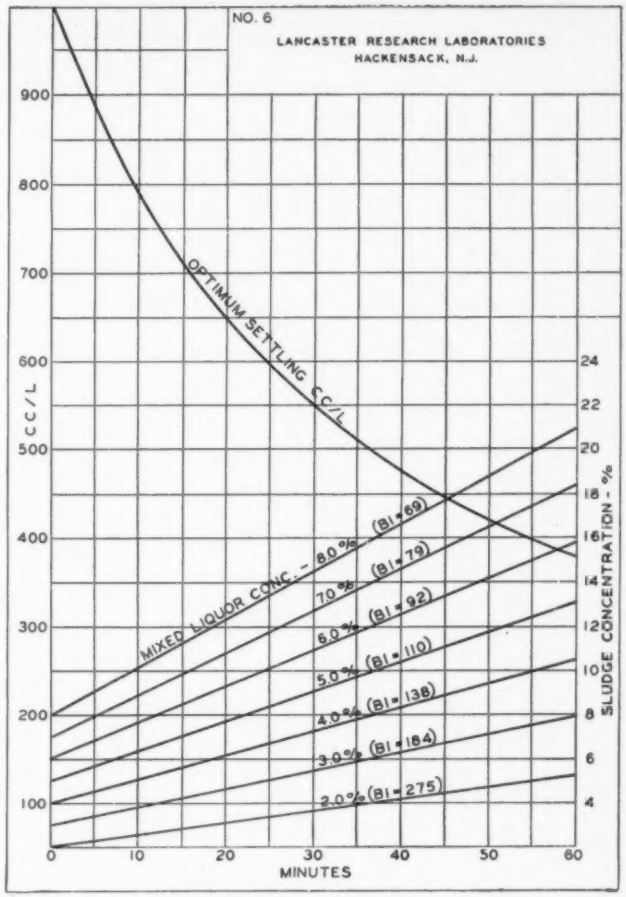
To provide simple and comparative values, I have selected treatment works having aeration-sedimentation ratios varying from 2:1 to 8:1. For purposes of simplicity in discussion, I have also adopted an uniform mixed liquor concentration of 2,000 ppm. for each of the hypothetical cases exhibited. Examining these data, we find that the optimum 30 minute settling rate of the sludge in a treatment works having an aeration-sedimentation ratio of 2:1 is 500 CC/L or 50%. At the mixed liquor concentration of 2,000 ppm. or .2%, the optimum B.I. would be 250, or considerably higher than the value claimed to define "Bulking sludge."

It will also be observed that the optimum settling rate of sludge in 30 minutes in a plant having an aeration-sedimentation ratio of 8:1 will be 125 CC/L or 12.5%. At the same mixed liquor concentration, this settling rate would indicate a B.I. of 62.

It is to be particularly noted that each of the settling curves shown represent an optimum sludge condition in plants having aeration-sedimentation ratios as indicated. With this in mind it is clear that under optimum conditions as these various plant ratios the "Bulking Index" will vary from 62 in the case of an 8:1 ratio plant to 250 in the case of a 2:1 ratio plant.

It is not difficult to contemplate what would happen, if an operator accustomed to finding the highest degree of clarification and purification in his 3:1 ratio plant, at a mixed liquor concentration of 2,000 ppm., and a "B.I." of 167, should be transferred to a 6:1 ratio plant. Long before he reached a B.I. of 167 his new plant would probably be bulking merrily.

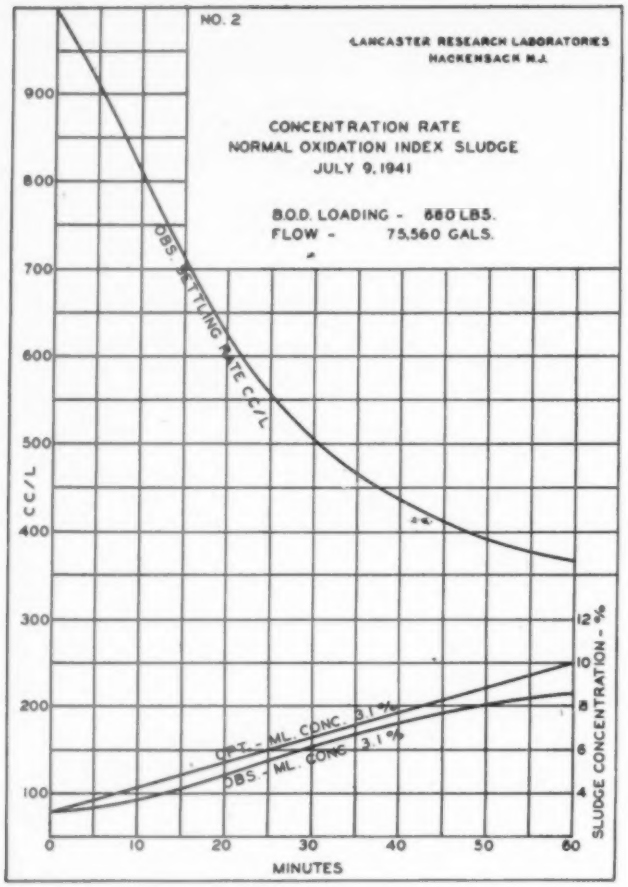
Conventional diffused air, municipal treatment are seldom qualified to maintain mixed liquor concentrations much in excess of 3000 or 3500 ppm. Mechanical aeration plants are generally limited to half these values. In treatment works erected during the past several years to provide greatly increased efficiencies and accommodate raw waste loadings of much higher concentrations, mixed liquor concentrations as high as 9,000 or 10,000 ppm. are employed. Let us see what the optimum B.I. would be in an 8:1 ratio plant at a mixed liquor concentration of 9,000 ppm. By the prescribed method of computation, this would exhibit a B.I. of 14.0, or considerably below the range contemplated by the investigators contributing to the development of the "Bulking Index."



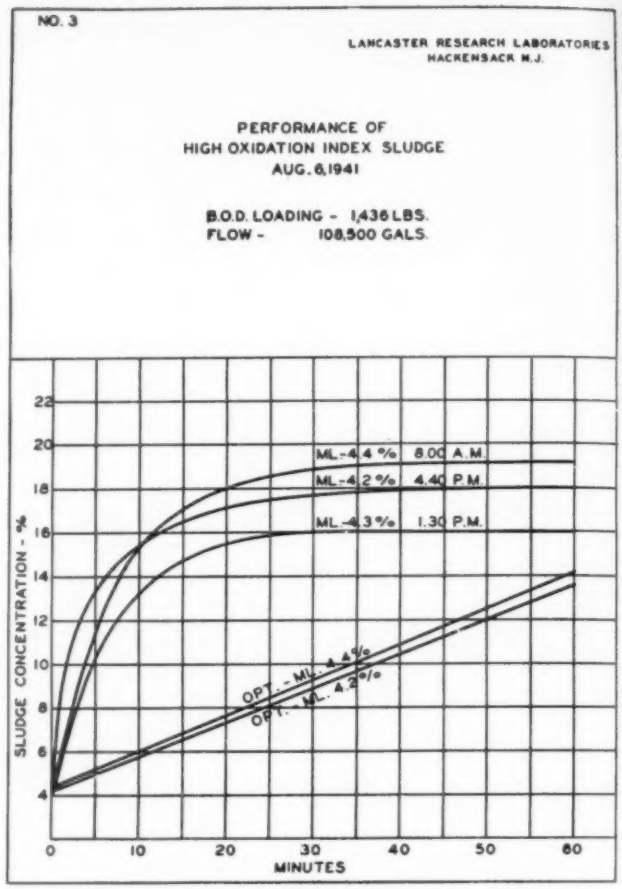
Graph 6—Optimum Settling and Various Concentrations of Solids in Mixed Liquor

Conversely, let us see what the 30 minute settling would be when the sludge was "slowly settling or bulking" according to the "Bulking Index" theory, i.e., B.I. = 200. This is found to be $.99 \times 200 = 180$ CC/L or 18.0%. Let us also see what the 30 minute settling would be according to the "Oxidation Index" theory at any mixed liquor concentration. By employing Equation No. 6, modified to reflect "Bulky" sludge, i.e., Oxidation Index = 50%, this is found to be $\frac{2000\ EC}{2AT - 3\ CT + 2EC}$ = 235 CC/L. According to the B.I. theory an index of 40 is regarded as indicating a "rapidly settling sludge" and considered desirable. It is shown in this example, however, that "Bulking" sludge would be indicated by a B.I. of 26, i.e., $\left\{\frac{23.5}{.9} = 26\right\}$ and that a serious condition of bulking would be present at an index of 40. The original mechanical aerator plant at Monroe, Wisconsin, reflected a ratio somewhat of this order. How many operators would agree that conditions were critical when the 30 minute settling was 180 CC/L or even 236 CC/L. Possibly this may explain the reports of operators that "bulking occurred suddenly and without warning although the settling had been good for days." Why blame industrial wastes, Sphaerotilus, or other irrelevant factors for the trouble, when the cause is man made and right in the treatment works.

Graph No. 6 illustrates an optimum settling curve for a plant in Pennsylvania in which the aeration-sedimentation ratio is only 1.815:1. This graph also includes a related family of sludge concentration curves, corresponding to mixed liquor values varying from 2000 ppm. up to 8000 ppm. For purposes of this discussion there is included the "Bulking Index" at the various mixed liquor concentrations when the sludge in this plant is in an optimum condition. This graph is somewhat similar to Graph No. 1. From



Graph 2—Example of "Oxidation Index" Curves Indicative of Normal Plant Conditions



Graph 3—Concentration Rates and "Oxidation Index," Indicative of a High Index Sludge

these data it will be seen that at a mixed liquor concentration of 8%, equivalent to 8,000 ppm., the B.I. would be 69. This means that sludge at any B.I. value above 69 would be approaching toward bulking, and at any value below 69, the sludge would be above optimum or over-oxidized. It is similarly evident that at a mixed liquor concentration of 2%, equivalent to 2,000 ppm., the B.I. is 275. If we are to interpret the "Bulking Index" as it was originally presented, it would mean that sludge bulking would be indicated long before this value was reached. Quite the contrary, however, the sludge would be in an optimum condition at this mixed liquor and B.I. value. It must be evident from a study of this graph that the B.I. value cannot be reliably informative if interpreted in the unqualified manner in which it was originally presented.

Graph No. 2 illustrates an observed settling curve at a treatment works having an aeration-sedimentation ratio of 2.11:1. The concentration rate computed from this observed settling curve indicates that the sludge condition is slightly below optimum. The settling at 30 minutes is indicated as 510 CC/L equivalent to 51%. At a mixed liquor concentration of 3,100 ppm., this would indicate a B.I. of 164. The optimum settling rates of mixed liquor of this concentration in this particular plant at 30 minutes would be 470 CC/L or 47%. This would represent a B.I. of 152 at optimum sludge conditions.

In discussing the previous graphs, it was shown that bulking would be approached in one instance at a B.I. over 26, and that optimum conditions or better were evident in another plant at any B.I. value up to 250. In the present instance, the sludge at a "B.I." of 164 is below the optimum. Unless corrective measures are adopted and the trend toward bulking reversed, bulking is certain to occur.

In the course of the discussions following the presentation of the paper before the American Society of Mechanical Engineers, Mr. Enslow remarked that it seemed to him that the simple methods of test and interpretation developed in the presentation of the "Oxidized Sludge Process" theory resulted in constituting the treatment cycle itself as the best indicator of processing conditions. Perhaps this may be more clearly evident by a study of Graph No. 3. These data relate to the same treatment plant considered in Graph No. 2. This particular treatment plant is at times subjected to sudden and very substantial loadings and overloads. These loadings consist largely of whey and curd wash waters which exhibit B.O.D. and volatile solids concentrations in the neighborhood of 60,000 ppm. and an acidity component in the neighborhood of 3,500 ppm. The secondary treatment process or aerator-clarifier at this plant has a nominal full load capacity of 1,000 pounds of five day B.O.D. per day at a normal full load flow rate of 100,000 gpd.

Examining this graph, it is observed that at 8 a. m. the mixed liquor concentration was about 4,400 ppm., which settled to 232 CC/L in 30 minutes. During the morning hours a loading of about 800 or 900 pounds of B.O.D. was delivered to the aerator. By 1:30 p. m. the reflection of this loading on the sludge characteristics is clearly apparent. The sludge which reached a concentration of more than 19,000 ppm. after settling 60 minutes at 8 a. m. only reached a concentration of 16,000 ppm. at 1:30 p. m. The "Oxidation Index" or ratio of the observed concentration in 60 minutes to the optimum concentration in 60 minutes

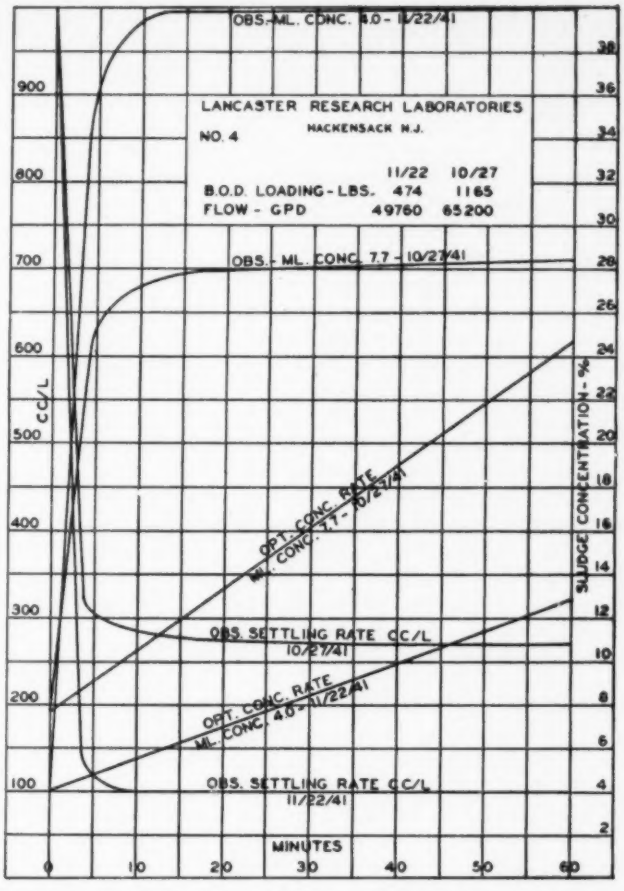
was approximately 135% at 8 o'clock in the morning. At 1:30 p. m. the "Oxidation Index" was decreased to approximately 115%. The remarkable ability of well oxidized sludge to accommodate shock loads of this character is well illustrated in comparing the 1:30 p. m. data with that exhibited at 4:40 p. m. The shock load was not only accommodated, but the process exhibited a definite ability to recover some of the decreased capacity of the sludge caused by the shock load. At 4:40 it will be observed that the "Oxidation Index" had increased to over 130% or nearly a complete restoration of the sludge condition existing before the shock load was delivered to the plant.

There was no visible evidence of these changes in processing conditions, yet the operator was able to tell accurately from time to time just what effect the heavy loading was having on the process and to make any necessary adjustments. I know of no other method of measurement which provides such prompt and accurate knowledge of processing conditions which may be expressed numerically and accordingly become accurately informative.

Oxidation Backlog—Its Value

When known overloads of serious proportions are to be expected, it is practicable to maintain an "Oxidation Index" substantially above optimum or 100%. In the various principles enumerated and the evaluations of sludge condition exhibited in the graphs, I have used the term "Optimum" advisedly as a theoretical basis of reference. At the optimum point the process will exhibit its highest degree of clarification and purification. The term "Optimum" has a further significance. The designer may devise his clarifier characteristics to coincide with this optimum rating and insure that normal conditions will prevail under the range in flow and loading rates experienced during each diurnal period. In addition, the definite rating of "bulky" sludge coincides with the condition which permits sudden excess flow rates to cause actual bulking through mechanical causes. A preliminary element in our service to municipal clients is an analysis of existing plant characteristics and the delivery of a certified rating of the continuous full load capacity of the plant, the one day overload capacity, the normal flow rate capacity, one hour maximum flow rate capacity, and two hour maximum flow rate capacity.

It does not necessarily follow that a plant should be operated at the optimum point under all circumstances. In municipal plants where the daily loading is reasonably uniform and shock loads are seldom if ever experienced, and particularly at plants under the supervision of competent operators throughout the diurnal cycle, it is, of course, practicable to hew pretty close to the line. In plants subjected to shock loadings, however, it is practicable to maintain the sludge in an over-oxidized condition and frequently in larger amounts than the optimum volume. Compensation to accommodate shock loadings may be provided in several ways best suited to the circumstances. The maintenance of normal sludge concentrations and volumes at an excessively high "Oxidation Index" is one method. Another method may be the maintenance of abnormal sludge concentrations and volumes at a reasonably high "Oxidation Index." If greatly excessive overloads are anticipated, appropriate combinations of these methods may be employed.



Graph 4—A Comparison of Days of Normal vs. Temporary Underloading—("Oxidation Index" of 115% vs. 310%)

Graph No. 4 illustrates two extreme conditions which may be brought about to accommodate loadings. The mixed liquor concentration on October 27 is shown as 7,700 ppm. The settling rates indicated a slightly over-oxidized sludge with an Oxidation Index of about 115%. The settling rate at 30 minutes was approximately 270 CC/L, or 27%, equivalent to a B.I. of 36. This B.I. value would suggest particularly high quality sludge as defined by the B.I. theory. It is shown, however, that this sludge only exceeded the optimum condition by a scant margin of 15%.

On November 22 the mixed liquor concentration was 4,000 ppm., and the settling rate at 30 minutes 100 CC/L, or 10%, equivalent to a B.I. of 25. The Oxidation Index on this date was approximately 310%, indicating that the sludge could comfortably carry a shock overload of 200% without difficulty.

In the performance graphs discussed so far, there have been no representations of high settling and correspondingly low oxidation indices, indicating substantially under-oxidized or "bulky" sludge.

Graph No. 7 illustrates conditions which developed at a treatment works in Pennsylvania when a new and inexperienced operator replaced the experienced operator inducted into the military service. On February 10, the mixed liquor concentration was 2,500 ppm., the settling rate in 30 minutes 940 CC/L or 94%, and the equivalent B.I. was 376. Considered in terms of the Oxidation Index method of evaluating the sludge conditions, it is shown that the concentration rate was considerably below the optimum straight line and indicative of imminent difficulties. On February 14 the mixed liquor concentration was 4,000 ppm., the settling rate in 30 minutes was 880 ppm. By reference to the concentration curve, it will be observed that the rate on this date was similarly considerably below the optimum straight line. It is believed that one of the most valuable aspects of the present method of evaluating

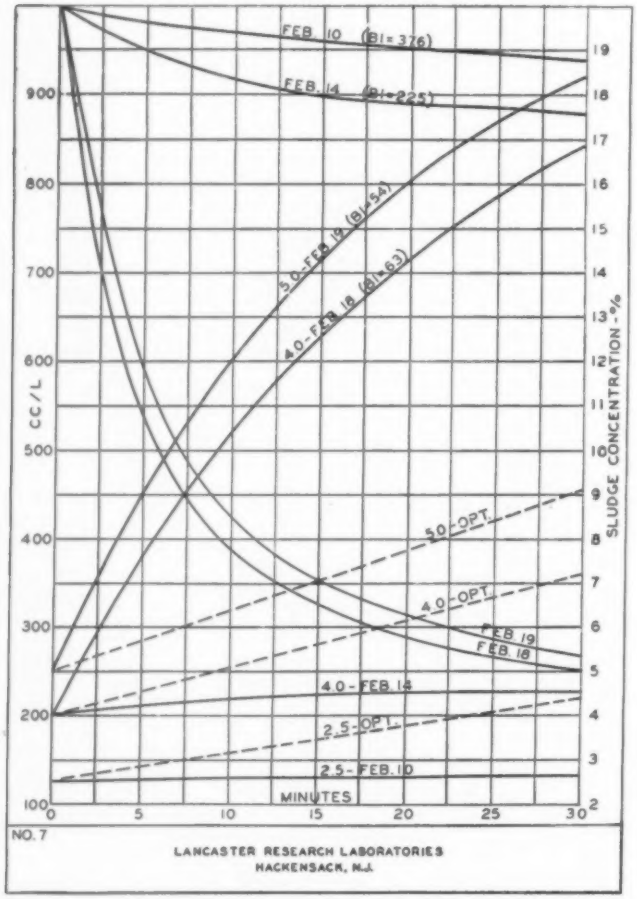
processing conditions and determining appropriate control measures is the ability to express conditions in numerical values and to interpret promptly the processing cycle conditions. In this instance, another factor is involved coming within the scope of the second general principle hereinbefore enunciated, namely, the amount of the sludge in the system.

Time will not permit and it is beyond the scope of this discussion of one element of process measurement and control to examine into the factors relating to sludge volume. Sufficient to say that a neglect to withdraw excess sludge from the system for a period of nearly two weeks had caused the accumulation of an excessive volume of solids in the cycle. The sludge per se in a treatment cycle represents an oxidation demand and may be regarded as an element of residual loading. This particular treatment plant has been subjected to consistent daily overloading up to 100% overload for the past several months. This excessive raw waste loading combined with the excessive residual loading naturally brought about the sludge condition as shown on February 10 and 14.

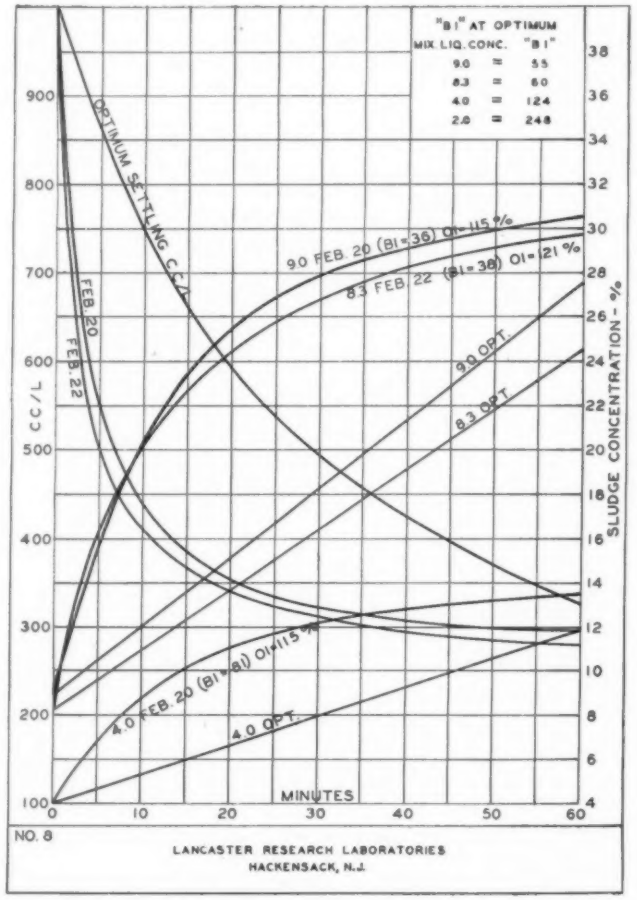
In this case we were informed of the circumstances by long distance telephone on February 16, when conditions were substantially the same as those exhibited on February 10 and 14. The remedial measures prescribed were immediately effective and attained over-compensated proportions on the 18th. As shown on this graph, the mixed liquor concentration on February 18 was 4,000 ppm. The settling rate in 30 minutes was 250 CC/L or 25%, equivalent to a B.I. of 63. While not shown on this enlarged scale graph, the Oxidation Index was about 200. On the following day, February 19, the mixed liquor concentration was 5,000 ppm. with a corresponding settling rate in 30 minutes of 270 CC/L, equivalent to a B.I. of 54. In this instance also the Oxidation Index was approximately 200%.

This illustrates another element of consideration in our service to clients, our constant readiness to advise, when difficulties are shown to be imminent by the prescribed simple tests. This service is available alike to those for whom we have designed and erected treatment works as well as municipalities who have engaged us to convert existing Activated Sludge plants to the Oxidized Sludge Process method of control. Having accurate methods of measurement and control, expressed in numerical values, renders it easily possible for the operator to give us a precise knowledge of conditions and we, in turn, can prescribe remedial measures promptly and accurately. This exchange of information can be made by telephone, telegraph, letter or any other means of communication. This practice has proved to be a great aid to operators until they become proficient in interpreting test results and applying proper controls.

Governing bodies of municipalities and managements of industrial corporations are generally very willing to support the plant superintendent or operator in his desire to obtain the best possible operating performance, and will readily approve a recommendation from the superintendent or operator to convert the treatment works to the Oxidized Sludge Process method of control to insure a uniformly satisfactory operation. In most instances this conversion will also enable the operator to show a substantial reduction in the unit cost of B.O.D. reduction. Invariably, the operator will find that his daily tasks are greatly simplified and much of the arduous work and worry eliminated,



Graph 7—Curves for Various Days at a Given Plant, Revealing What Can Happen.—See Text



Graph 8—Curves for Specific Plant and Operating Conditions.—See Text

as he is no longer dealing with uncertainties.

It may be further informative to study Graph No. 8. This graph exhibits actual data taken at a treatment works in Michigan on the dates shown. On February 20 it is shown that the settling in 30 minutes was 325 CC/L, equivalent to 32.5%. On this date the mixed liquor concentration was 9%, equivalent to 9,000 ppm. The B.I. computed from these values would accordingly be 36. The "Oxidation Index" was 115%. In these circumstances it is shown that the sludge was but slightly over-oxidized and well adapted to accommodate the normal loading on the plant. For comparison, let us assume an hypothetical case. If the mixed liquor concentration had been 4,000 ppm. on this date and the settling rate the same as shown, the B.I. would have been 81, but the Oxidation Index would have remained exactly the same, or 115%. In other words, the B.I. fluctuates without regard to process conditions in an ambiguous manner and offers no reliable basis of estimate of the conditions, particularly if no optimum condition is presented as a basis of comparison. On the contrary, the Oxidation Index is a relationship between the observed sludge condition and the optimum sludge condition, and the operator is, therefore, accurately informed as to whether the sludge is in a better condition than optimum, or in a poorer condition, and the degree of the difference.

This graph also reports the data taken at this plant on February 22. On this date the settling at 30 minutes was 310 CC/L, equivalent to 31%. The mixed liquor concentration was 8.3%, equivalent to 8,300 ppm. The B.I. was 38 and the Oxidation Index was 121%. It will be evident by comparing the February 20 data with the February 22 data that some increase in the degree of oxidation had occurred during the two day period.

I have also included on this graph an optimum settling curve for this particular plant. From this curve we may compute the B.I. values in comparison with those above. At a mixed liquor concentration of 9,000 ppm. on February 20 and an optimum settling rate, the B.I. would have been 55 instead of 36. On February 22, with a mixed liquor concentration of 8,300 ppm., the B.I. would have been 60. At a mixed liquor concentration of 4,000 ppm., the B.I. would have been 124. Had the mixed liquor concentration been 2,000 ppm. and the sludge had been in an optimum condition, the B.I. would have been 248. Here again, a B.I. value considerably above 200 defines an optimum condition rather than a bulking condition.

The majority of activated sludge plant operators are research minded, whether they realize it or not. I embrace every opportunity to visit treatment works, and I can assure you I always learn something. Years ago an operator told me he always kept his sludge settling in 30 minutes at 20% or less. He was right. He had learned the hard way over a period of many trying years. His plant had a high ratio, demanding this order of settling.

This thought may be confirmed by the compilations of opinions reported by A. P. Banta, Assistant Professor, Sanitary Engineering, California Institute of Technology, Pasadena, Calif., in the May, 1941, issue of WATER WORKS AND SEWERAGE:

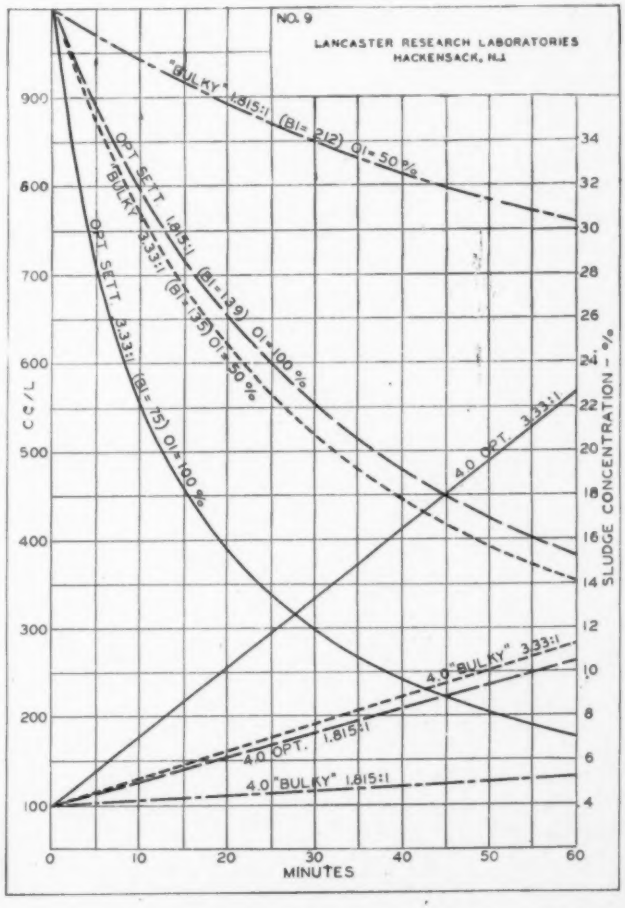
"When the sludge percentage exceeds 300 cc. in a liter graduate, sludge should be withdrawn. Some plants have found by experience to operate more efficiently at a lower per cent."

Let us see what the plant characteristics would be that would make this observation practicable. From Graph No. 9 we may readily determine that sludge settling to 300 CC/L in 30 minutes under optimum conditions would indicate a plant having an aeration - sedimentation ratio of 3.33:1, as indicated by the solid line. We may similarly determine by reference to the dotted line that "bulky" sludge would be evident at a 30 minute settling of 525 CC/L.

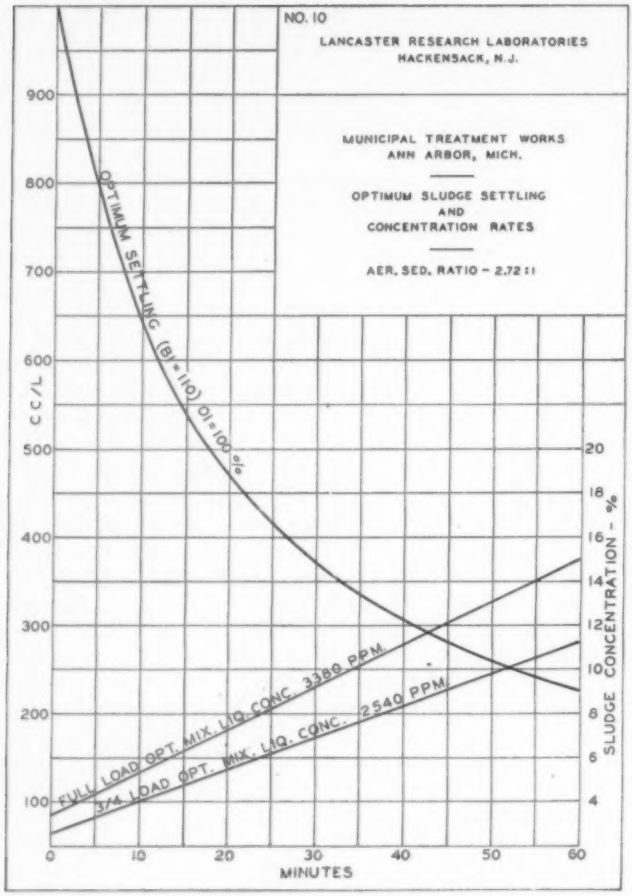
Unfortunately, the knowledge born of experience at one plant cannot be employed at other plants, nor with uniform success at the original plant. For example, let us again reproduce the optimum settling curve from Graph No. 6 relating to a plant having an aeration-sedimentation ratio of 1.815:1, as shown by the dash line. It is readily evident that the optimum 30 minute settling at this plant (550 CC/L) is higher than the rate indicating bulking at the 3.33:1 ratio plant. I believe this clearly shows the danger of trying to follow the practice someone else has found to be desirable, unless the data are related to a common basis. The "bulky" settling rate curve for the 1.815:1 ratio plant, dash-dot line, is self explanatory.

It may appear that a great amount of computations, curve plotting and other technical studies are necessary to obtain a knowledge of processing conditions. To the extent that the sludge condition, as defined by the principles enunciated herein is concerned, it is only necessary to compare the settling rate with the optimum settling rate at any particular plant.

I am informed that the aeration tanks at the Ann Arbor Treatment Works have a holding capacity of 1,400,000 gallons, and the final clarifiers 514,800 gallons. This indicates an aeration-sedimentation ratio of 2.72:1. Predicated on these data, Graph No. 10 shows the optimum settling rate curve for this plant at



Graph 9—Curves for a Plant Sludge at Optimum and Sub-Optimum Index Values.—See Text



Graph 10—Curves for Optimum Settling and Concentration Rates Producing Results at a Municipal Plant.—See Text

an "Oxidation Index" of 100% or optimum. As long as the settling rate is maintained below the optimum line, there need be no fear of bulking. I have also shown the optimum sludge concentration rate curves at full load and three-quarter load. As long as these values are maintained at the corresponding loading, a good effluent may be assured. If the settling is higher than the optimum rate, it is an indication that something must be done to improve the processing mechanism conditions. The operator may well regard the sludge as the principal mechanism in his processing cycle and devote his interest and effort to a determination of the sludge condition as a first element in the maintenance of satisfactory conditions.

The Standard "Settlometer"

In the paper published last August I discussed the disparities evident in determining settling rates in a variety of conventional laboratory cylinders. The data discussed today relates to settling rates determined in a standard two litre "settlometer." This particular cylinder is illustrated as the third from the right in the accompanying picture. From left to right the cylinders illustrated are: 100 ml., 250 ml., 500 ml., 1,000 ml., and 2,000 ml. standard laboratory cylinders. The four cylinders on the right are in continuing sequence, a one litre settlometer, a two litre "standard settlometer," a seven litre special settlometer, and a sixteen litre cylinder, the two man power, or grandfather of all settling glasses, designed for special laboratory studies.

Predicated on the use of a standard settlometer, the first step in making an accurate measurement of the condition of the sludge in a processing cycle can be made with reasonable and practicable accuracy. Until such time as the other individual elements of measurement and control of the "Oxidized Sludge Process" can be fully presented in a similar manner, it is suggested that interested operators obtain and study a copy of the paper published in the August, 1941, issue of WATER WORKS AND SEWERAGE.

In pointing out the ambiguities and impracticabilities of the "Bulking Index," it is not the intent to criticize work which at the time of its publication may have represented the best opinions in some branches of the art. While the Oxidation Index was developed and had been in practice for several years before the publication of the "Bulking Index," its principles had not been publicly pronounced. It is submitted that the "Oxidation Index" and the principles discussed today provide an advanced step in our understanding of the mechanism of the aeration-sedimentation method of treatment, and that they may well be substituted for less practical methods and employed until such time as a further advance in our knowledge of the subject may permit someone to devise an even better method.

Engineering Research Association Formed

In Which 73 Engineering Colleges Will Cooperate to Reduce Duplication and Waste Through Coordination

The formation of The Engineering College Research Association by seventy-three engineering colleges from all parts of the country to cooperate with the war agencies of the government and with war industry in the prosecution and promotion of research needed for the war effort has just been announced.

Headed by W. R. Woolrich, Dean of Engineering at the University of Texas, the Association's first undertaking will be that of coordinating the research activities of the engineering college laboratories and personnel for the task of conducting vital studies affecting war materials and production. It will also assist in organizing the research facilities of the engineering colleges in undertaking studies designed to promote post-war reconstruction and economic adjustment through new and improved processes affecting industry, public works, the conservation and development of natural resources, public health, and other similar activities. It is further planned that the group will act as a continuing agency for developing and coordinating scientific and industrial research and the furtherance of advanced study in the colleges of engineering in the United States.

A very much worth while and practical aspect to the scheme is that through the cooperation of such a large number of leading engineering schools expensive and wasteful duplication of effort can be avoided. Therefrom, a maximum utilization of facilities and personnel and a high degree of coordination will result.

In addition to Dean Woolrich as president other officers of the new Association are: Dean Earle B. Norris, Virginia Polytechnic Institute, first vice-president; President C. C. Williams, Lehigh University, second vice-president; Dean R. L. Spencer, University of Delaware, treasurer. Council members of the group are Dean Ivan C. Crawford, University of Michigan; Dean Thorndike Saville, New York University; Dean Samuel B. Morris, Stanford Unievrsity; Dean F. M. Dawson, University of Iowa; Dean N. A. Christensen, Colorado State College, and Dean G. M. Butler, University of Arizona.

MEETINGS SCHEDULED:

Jan. 20-21—NEW YORK, N. Y. (Eng. Societies Bldg.)
American Society of Civil Engineers. (Annual Meeting.) Exec. Sec'y, Geo. T. Seabury, Eng. Societies Bldg., 33 W. 39th St., New York, N. Y.
(Sanitary Engineering Div. Sessions, Thursday, Jan. 21.)

Jan. 20-21—BOSTON, MASS. (Hotel Statler).
New England Water Works Association. (Air Raid Precaution School). Secretary, F. J. Gifford, 613 Statler Building, Boston, Mass.

Jan. 22—NEW YORK, N. Y. (Hotel McAlpin).
New York State Sewage Works Ass'n. (Hotel McAlpin.) Sec'y-Treas., A. S. Bedell, State Dept. of Health, Albany, N. Y.
(Joint Annual Dinner of N.Y.S.S.W.A., and the Sanitary Eng. Div. of A.S.C.E., Jan. 22. Inspection trip scheduled for Jan. 23, cancelled.

Feb. 10 (tenative)—PORTLAND, ME.
Maine Water Utilities Association. Secretary, Earle A. Tarr, Winthrope, Me.

Feb. 18—BOSTON, MASS. (Hotel Statler)
New England Water Works Association. (Monthly Meeting.) Secretary, F. J. Gifford, 613 Statler Building, Boston, Mass.

Feb. (Date to be set)—COLLEGE STATION, TEXAS (A. & M. College).
Texas Water Works & Sewerage Short School. Secretary, V. M. Ehlers, Austin, Texas.

Mar. (Date to be set)—TRENTON, N. J. (Stacy-Trent Hotel).
New Jersey Sewage Works Association. Secretary, John R. Downes, Plainfield, N. J.

Mar. 12-13—MINNEAPOLIS, MINN. (Nicollet Hotel).
Minnesota Section, A.W.W.A., Sec'y-Treas., R. M. Finch, 416 Flour Exchange, Minneapolis, Minn.

Mar. 25-26—SYRACUSE, N. Y. (Hotel Syracuse).
New York Section A.W.W.A. (Spring War Conference.) Sec'y-Treas., Rollo K. Blanchard, 50 West 50th St., New York, N. Y.

Apr. 7-9—HAMILTON, ONTARIO (Royal Connaught Hotel).
Canadian Section A.W.W.A. Sec'y, A. E. Berry, Ontario Department of Health, Parliament Bldgs., Toronto, Ont.

May 7-8—BELLINGHAM, WASHINGTON
Pacific Northwest Section, A.W.W.A. Secretary, Fred Merryfield, Engineering Laboratories, Oregon State College, Corvallis, Ore.

June 14-17—CLEVELAND, OHIO (Carter & Statler Hotels).
The 1943 A.W.W.A. Conference on WAR WINNING Water Works Operations. Executive Secretary, Harry E. Jordan, 22 East 40th Street, New York, N. Y.

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LITERATURE AND CATALOGS

National Gate Valves and Sluice Gates are described and illustrated in a new folder released by the National Machine Works, specialists in the design and manufacture of water and sewage works equipment for the past 50 years. Gate valves are furnished in a range of sizes covering all water works requirements and may be supplied with hub, flanged, screwed, spigot or Universal ends. They are of the double disc, parallel seat type, and are heavily proportioned to a high factor of safety to meet every condition of operating service.

National sluice gates are offered in both rising stem and non-rising stem types, and for electric, hydraulic or hand operation. Frames are made of a high grade of semi-steel and are available in designs which take care of all usual methods of securing the gate to its foundation. Gate stems are furnished in the material specified by the purchaser. A copy of this bulletin can be obtained from the National Machine Works, 1559 N. Sheffield Ave., Chicago, Ill.

Wartime Care of Centrifugal Pumps is a valuable little handbook just published by Allis-Chalmers Co. However, its context applies not alone to A-C pumps but to every make of centrifugal.

Interestingly illustrated throughout, it begins with the suggestion, "Let's Build a Pump!" and proceeds descriptively and pictorially to assemble a complete pump from shaft to bonnet. Now that the reader is familiar with the several parts which constitute the innards of a centrifugal, and the reason for and service of each, he is then familiarized with what can happen to permanently damage or reduce the efficiency of centrifugals.

In the rear of the booklet is a quick reference chart which reveals "How to Locate Troubles" and their "Causes and Cures." To complete the job, a "Maintenance Timetable" is spread out over the last two pages. This very much worth having little 28-page booklet is a sister handbook to the earlier A-C "Guide to Wartime Care of Electric Motors," both of which emphasize that "In maintenance, as in war, attack is the best defense." Just for the asking, copies of "Wartime Care of Centrifugals" and the "Guide to Wartime Motor Care" may be had from Allis-Chalmers Co., Milwaukee, Wis.

"Water Production for Industrial and Municipal Use" is the title of an illuminating 24-page booklet just published by the Ranney Water Collector Corp. discussing the water supply problems created in many communities by the development of war industries, and methods which the Ranney organization has perfected to solve these problems.

When used as a ground water collector, the Ranney well consists primarily of a monolithic shaft of 13 ft. inside diameter. The shaft is sealed at the bottom with a reinforced concrete plug, and perforated screen pipes, 8 in. in diameter, are projected horizontally out into the aquifer at selected levels. The infiltration unit is similar in design and permits the abstraction of water from beneath rivers and lakes.

The Ranney method of abstracting water from the ground is based

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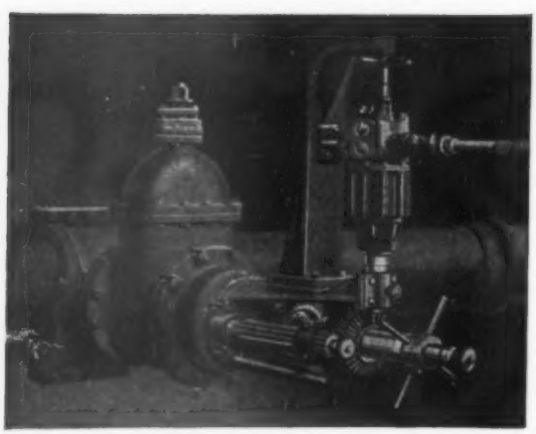
without interrupting the continuous flow of vital water to other points on the same line. These machines are made to make taps from 2 inches to 42 inches. They are easy to handle and economical to use and are the most reliable machine for the purpose made.

The larger machines are for rent and we supply supervision in their use. The smaller ones may be bought or rented.



Above: Smith Tapping Machines, for making branch connections to water and gas mains under pressure, have been standard equipment throughout the U. S. since 1889.

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on the exposure of a large area of the water-bearing formation to horizontal screen intake pipes; the selective removal of the fine material from the aquifer, so as to form more permeable ground or a gravel pack adjacent to the screen; and the access to, and independent control of, each radial horizontal pipe leading out from the large diameter dry well. Drawings and photographs help explain the operating features of the units. For a copy of this interesting booklet on water production, write to the Ranney Water Collecting Corp., Heyburn Bldg., Louisville, Ky.

Rapid Mixers for Flocculation Tanks is the subject of an illustrated folder recently released by the Link-Belt Company describing their "straightline" slow mixers. Efficient collision and coagulation of finely divided suspended matter is accomplished through the use of across-the-flow paddle rotation, which gives a swirling motion to the liquid. The influent channels and baffles have been carefully designed to assure good distribution and prevent short circuiting of the flow through the tank. Several other unique features are described and illustrated with drawings. Photographs of several large sewage plants are shown. Other Link-Belt sewage equipment briefly described in the folder include rapid mixers, collectors, bar screens, scum breakers and waste screens. A copy of this folder (No. 2042) can be obtained by writing the Link-Belt Co., 307 N. Michigan Ave., Chicago, Ill.

Worthington Gas Engines for Sewage Works are described and illustrated in a new bulletin, No. S-550-B21. These vertical, four-cycle, totally enclosed engines (known as type CCG) are adaptable to generators, pumps, compressors and other power drives; they are recommended for operation on sludge gas generated in modern sewage disposal plants. The bulletin describes all constructional details of the equipment and contains a simplified cross-sectional drawing depicting numerous special features. The CCG engine is fitted with a circulating pressure system which insures an ample supply of lubricating oil to all working parts. A lubricating oil pump draws oil from the sump at the bottom of the engine base and pumps it through a strainer and oil cooler to a joint-

(Continued next page)

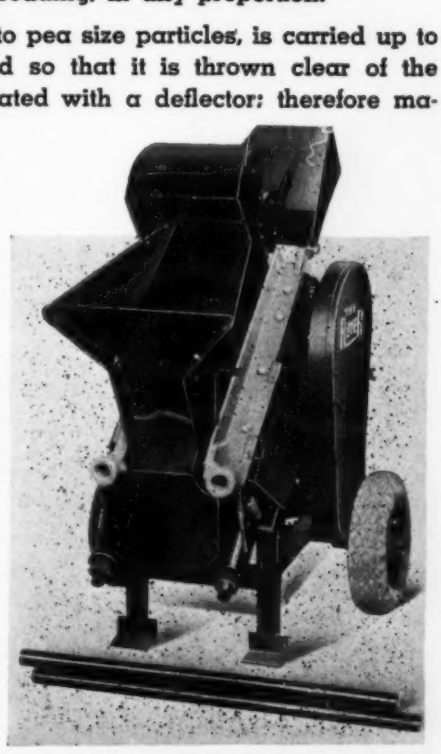
Throwing Away Money Along With Your Sludge?

When you bury or burn your sludge, you are spending money to get rid of something which many other sewage disposal plants are making use of or selling at a continuous profit, with the help of the Royer Sewage Sludge Disintegrator.

Sewage sludge has very effective fertilizing properties, being rich in soil-building elements. But sludge as it comes from the drying beds, caked and full of lumps, stones and debris, is hardly in condition for use as a fertilizer. That's why so many sewage disposal plants are using Royers! This inexpensive machine makes high grade fertilizer out of your sludge with minimum labor. Just shovel the sludge into the hopper—the Royer does the rest.

The Royer's "combing belt", with its rows of steel teeth, travels upward at a 45° angle, and this motion—combined with the action of the teeth—thoroughly breaks up, shreds, mixes and aerates the sludge. Stones, sticks and other trash gravitate to the bottom of the belt, where a gate provides for easy removal. Sludge with a moisture content as high as 51% can be completely disintegrated, and the moisture substantially reduced. Where desired or necessary, enrichening chemicals can be thoroughly mixed in, during the shredding, in any proportion.

The disintegrated sludge, reduced to pea size particles, is carried up to the discharge opening and ejected so that it is thrown clear of the machine. The arc of fall is regulated with a deflector: therefore material can be loaded into trucks or wagons or onto stock piles.



After disintegration by a Royer, the sludge makes a fertilizer which can be profitably sold or used in city parks and municipal golf courses.

Royer Sludge Disintegrators are made in twelve portable and stationary models, with electric motor, gasoline and belt-to-tractor drives.

Write for literature, including data on the fertilizing value of sewage sludge.

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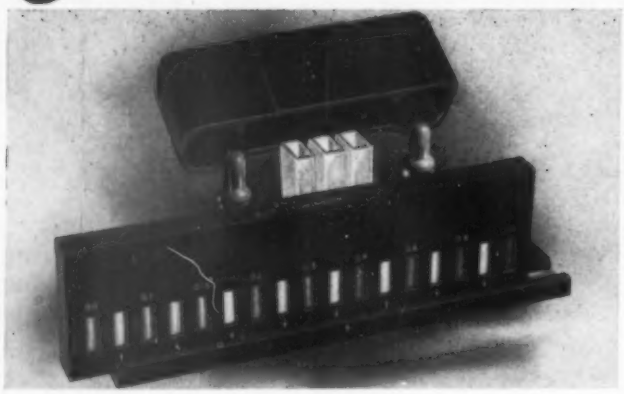
EASY CONTROL of *Chlorination!*



The Taylor-Enslow Slide Chlorimeter covers the range 0.0-1.0 or 0.0-3.0 ppm as desired. Price $18.50. The Taylor Super Chlorimeter has a range 0.2-8.0. Price, $16.00 f.o.b. Baltimore. Any of our pH color standard slides can be used with either outfit. All standards carry an *unlimited guarantee against fading.*

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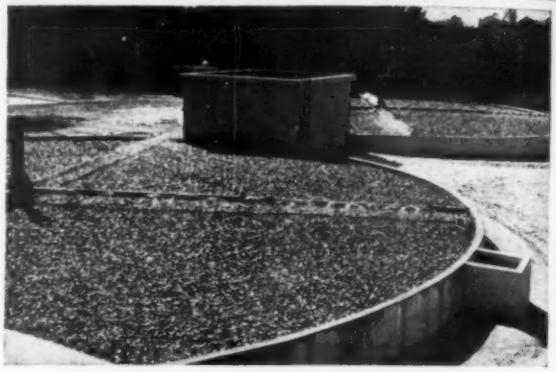

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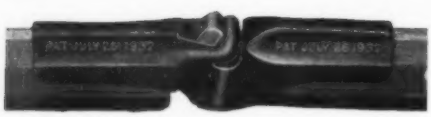

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Made of Selected Hickory with strong Malleable Iron Couplings, in 2½, 3, 3½ and 4 ft. lengths. Triple Lock, impossible to buckle or uncouple in the sewer. The tongue and groove feature eliminates wear on hook, increasing the length of service.

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less header cast in the base; oil passes from the main bearings, through drilled holes in the crankshaft, to crankpins, and then upward through the connecting rods to the piston pins. A table of dimensions and capacities is included. For a copy of bulletin (S-550-B21) write to Worthington Pump & Machinery Corp., Harrison, N. J.

Armco Emergency Wood Pipe* is presented as a wartime substitute for corrugated metal pipe in an illustrated bulletin recently issued by the Armco Drainage Products Association. The emergency product is recommended for essential culverts, storm sewers, underpasses, conduits and tunnels. It is light in weight but durable and capable of withstanding heavy loads. Under a properly tamped fill it reacts much like flexible metal pipe, deflecting slightly to reduce vertical load and build up side support.

The pipe, octagonal in shape, is fabricated from interchangeable wood segments joined together by wood pins. It is shipped in lengths

[*Think of it—a steel pipe manufacturer offering wooden pipe. This war has brought many strange things and here is an early example, for Armco early saw what was coming and did something about it. Result Armco Wood Pipe for the duration.—Ed.]

up to 16 feet. Diameter sizes range from 24 to 72 inches. The bulletin gives complete specifications and detailed suggestions for installation. For a copy write to the Armco Drainage Products Association, Middletown, Ohio.

"Electronics—A New Science for a New World" is the title of a beautifully illustrated 32-page brochure published by General Electric presenting the history of electronics, its miracles of today, and its great promise for the future. Electronics is the science of the electron—that tiny invisible particle of pure electricity which is now believed to be the basis of all familiar matter. By harnessing the power of the electron, science has extended the range of our intellect and senses. The brochure gives a fascinating account of the role electronics is playing in war combat; in radio and television; industry to step up production, increase human efficiency, and reduce material waste; in agriculture to improve quantity and quality; in medicine to reveal the structure and behavior of the human body; and in research to reveal more of nature's mysteries. The future of electronics is unknown, states the booklet. "Some day, extremely high frequencies of the spectrum may be applied to the wireless transmission of power. No one dares say otherwise!" A copy of this absorbing brochure (booklet GED-1024) can be secured by addressing the General Electric Co., Schenectady, N. Y.

Hot Process Water Softeners are described in Graver's new 24-page illustrated bulletin, Form 314. After a discussion of the advantages of hot process softeners in the elimination of carbon dioxide and oxygen, the bulletin gives a detailed account of the operation of a lime and soda hot process water softener. The Graver system consists of a sedimentation tank, a series of pressure filters, chemical mixing and proportioning equipment, and the necessary pumps and piping. Filters for the removal of the final suspended matter are usually of the vertical pressure type, and contain a media of non-silicious material graded from course at the bottom to fine at the top. Mixing tanks, disk type proportioners, remote control proportioners and various auxiliary equipment are shown. Numerous flow diagrams and cut-away drawings are used to help explain the design and operation of the equipment. For a copy of this bulletin (Form 314) write to the Graver Tank & Mfg. Co., Inc., East Chicago, Ill.

Wrought Iron for Underground Services is the subject of a new technical bulletin prepared by the engineering service department of the A. M. Byers Company of Pittsburgh. This 36-page illustrated bulletin discusses the most important factors affecting soil corrosion of underground piping and gives numerous service histories of water lines, sprinkling systems, water wells, oil and gas wells, tanks and electric cable conduits. The text points out the discrepancy between laboratory tests and actual experience, and advises the use of test results only when correlated with practical data. Several installation histories provide direct comparisons of wrought iron and other materials in the same service. The bulletin is generously illustrated with photographs of pipe installations under varying conditions. For a copy write the Engineering Service Dept., A. M. Byers Co., Pittsburgh, Pa.

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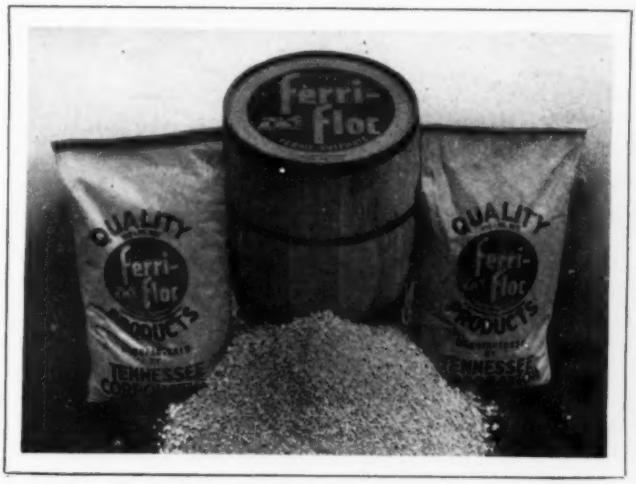
The Coagulant That Cuts Costs



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The ideal ferric coagulant for water and sewage treatment.
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Write for actual case histories of plants now using Ferri-Floc.

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4/5ths of the Y.M.S. MINESWEEPERS
DEPEND ON Westco PUMPS
for BOTH fresh and salt water supply
...and they are equally efficient in YOUR plant!
When fighting ships put to sea, they can't take chances with equipment breakdowns. Particularly in smaller vessels where repair facilities are limited and there's no room for standby equipment, absolute dependability is VITAL!
That's why it is doubly significant that in four out of every five YMS Minesweepers, Westco Pumps have been given the job of handling BOTH fresh and saltwater supplies. In addition, Westcos are going into Troop Ships, Sub-Chasers, Tankers, Coast Guard Cutters, and other naval vessels.
What better testimony is there to the amazing stamina, high efficiency, and rugged dependability built into Westco Pumps?
TAKE A TIP FROM THE NAVY. When you buy pumps for YOUR plant, remember—you can't beat Westco performance!
On Westco Pumps, wear and corrosion are taken by renewable liners. To renew pump, simply renew liners!
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Sewage-Treatment Works

Administration and Operation

By C. E. KEEFER

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673 pages, 6 x 9, 177 tables, 167 diagrams, charts, graphs, and illustrations, $6.00

This practical manual comprehensively presents the problems of administration, operation, maintenance and design of sewage-treatment plants, and how to handle them.

Drawing upon actual operating results and experience obtained at a large number of outstanding sewage works, this book covers sewage treatment in a thorough and practical manner—from characteristics and composition of sewage, through the various stages of treatment, to its eventual disposal.

Its 32 fact-packed chapters present facts about quantity and composition of sewage from institutions, municipalities and industrial plants in considerable detail to facilitate sewage analysis and application of proper treatment process. Modern apparatus and new methods developed over recent years are discussed in detail for the first time in any book.

Water Works & Sewerage

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288-D

"Conditioning Feedwater for High-Pressure Boilers" is an article by Austin C. Dresher, reprinted in pamphlet form by the Cochrane Corporation. In discussing the requirements of a balanced feedwater treatment, Mr. Dresher lays special emphasis on (1) maintenance of cleanliness of evaporating surfaces, (2) protection of boilers against corrosion, (3) prevention of carryover by reducing and controlling solids and alkalinity, and (4) protection against embrittlement. The article then describes and explains modern processes that are used in the conditioning of feedwater: evaporators, hot-process water softeners with various treating agents, and several types of Zeolite softeners. Several simplified drawings and test charts are included with the paper. For a copy of Mr. Dresher's informative article, write for Reprint No. 23, which is being distributed by the Cochrane Corporation, 17th and Allegheny Ave., Philadelphia, Pa.

Graphite Lubrication is the subject of a new handbook, published by the Nassau Laboratories, explaining the unique lubricating properties of natural colloidal graphite. When carried in lubricating oils and greases, the graphite makes its way to the metallic surfaces of bearings and produces on them an errosion-resistant "graphoided" skin. The handbook contains a comprehensive indexed list of applications and suggestions, designed to aid engineers in keeping their machines at peak performance. Another section describes each of the standard "cograph" concentrates, listing prices and recommended uses of each product. A copy of the "Graphite Lubrication Handbook" can be obtained by writing to the Nassau Laboratories, Hackensack, N. J.

"Extra Strength" Vitrified Clay Pipe is recommended for use under heavy duty highways, railways and airplane runways to resist unusual loads and sudden impacts. A new illustrated folder describes and gives dimensions of the pipe, specifications for which are set forth in American Association of State Highway Officials' Spec. No. M65-42. For a copy of the folder write to Clay Sewer Pipe Association, Inc., Oliver Building, Pittsburgh, Pa.

"Worthite" Pumps and Valves—for handling corrosive and abrasive slurries, is the subject of an informative special bulletin (No. W1530-B6) just received from the Worthington. The book discusses the problems faced by six large industries and their experience with various metals for handling corrosive solutions. In order to properly handle corrosive slurries a metal must be both hard and resilient. Consideration of such factors led to the development of "Worthite," a complex alloy containing over 50% nickel, chromium, molybdenum, silicon, manganese, and copper. The bulletin is illustrated with photographs of pumps and process plants and contains a listing of additional technical bulletins on slurry handling. For a copy of Bulletin W-530-B6 write to Worthington Pump and Machinery Corp., Harrison, N. J.

"Eight Ways to Speed Up Production" is the title of an attractive new folder describing eight handy tools of the Ideal Commutator Dresser Co. Electric etchers and electric markers are used to avoid confusion and delay by permanently marking tools and materials. Whereas the etcher burns into the metal, the marker acts in the man-

(Continued next page)

The Pace Setter

Don't jeopardize your Investment

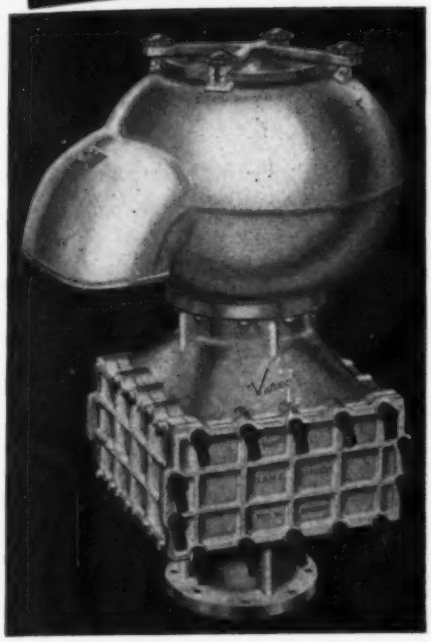

Fig. 58C "VAREC" Pressure Relief and Vacuum Breaker Valve with Flame Arrester.

FOR COMPLETE SEWAGE GAS CONTROL, SPECIFY

"Varec" Approved EQUIPMENT

The cost of controlling all combustible sewage gas with safety is a relatively small part of the total investment of your Treatment Plant. The installation of "VAREC" Sewage Gas Control and Safety Devices eliminates the danger of fire hazard and gas explosions. Specify "VAREC" and you will not jeopardize your investment of the Treatment Plant. "VAREC" Engineers will collaborate with you at any time.

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Pressure Relief and Vacuum Breaker Valves —Flame Arresters—Waste Gas Burners—Regulators—Check Valves—Manometers—Drip and Sediment Traps—Manhole and Manhole Covers—Sampling Hatches.

The VAPOR RECOVERY SYSTEMS CO.
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ner of an electric hammer, tapping 7,200 cutting strokes a minute. The electric marker is recommended for marking most metals, as well as tile, glass, porcelain and plastics. Also described in the folder is the Ideal Balancing Ways, for balancing crankshafts, armatures, and similar equipment. The Grinding Wheel Dresser next shown is capable of a cutting and truing effect almost equal to diamond. It is recommended for dressing out deep grooves, restoring out-of-balance wheels, and shaping wheels into different forms for special form grinding. Another interesting item is the Ideal "3-in-1" Cleaner, which blows or vacuums dirt from hard-to-get-at places. A copy of the folder may be obtained by writing Ideal Commutator Dresser Co., 1277 Park Ave., Sycamore, Ill.

Sewage and Sludge Pumps manufactured by Lawrence Machine and Pump Corp. are illustrated and described in their new Bulletin 206-2. These "non-clogging" pumps are efficient in handling sewage containing trash, rags, fibrous material, grit, and even large solids. Both horizontal and vertical pumps are supplied in sizes from 4-in. to 24-in. A significant feature of the Lawrence pump is an enclosed-type impeller, accurately machined on the outside and finished by hand on the inside and over vanes. Impellers are available in either cast iron or bronze. A key and special nut for securing impeller to the shaft has likewise been designed to avoid any obstruction to flow. Besides several photographs of pumps as utilized in industry, the bulletin contains a cross-section drawing showing all important parts of the unit. Pump sizes, capacities in g.p.m., and maximum diameter of solids safely handled are conveniently tabulated. For a copy of bulletin 206-2 write to Lawrence Machine and Pump Corp., 371 Market Street, Lawrence, Mass.

The "Dustfoe" Respirator is described in a bulletin just issued by the **Safety Appliance Co.** It is new. A "single filter," replacing the two-part filters used previously, gives protection against even a broader

(Continued next page)

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ALTITUDE VALVES • SURGE • RELIEF • BACK PRESSURE VALVES

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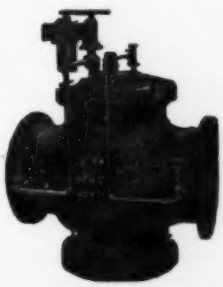
ALTITUDE VALVES
for
Control of elevation and heads into and out of tanks, basins and reservoirs.
1. Single acting.
2. Double acting.
3. Combination assembly for three or more automatic operations.

COMBINATION VALVE
Combination automatic control both directions through the valve.
A self-contained unit, with three or more automatic controls.

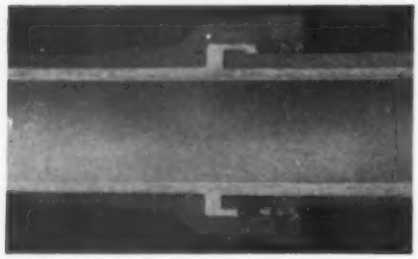


REMOTE CONTROL VALVE
Electric remote control—solenoid or motor can be furnished.
Adapted for use as primary or secondary control on any of the hydraulically controlled or operated valves.

ROSS VALVE MFG. CO.
INCORPORATED
P. O. BOX 595, TROY, N. Y.

View showing Tate Process in Pipe Joint. Note thoroughness of Lining.

Help Save Critical Materials · investigate TATE Cement Lining Process



With the increase in demand for Critical Materials in the Water Works field *now* is the time to investigate the Tate Cement Lining process—and see what it can do to restore the efficiency of your old water mains.

THE TATE PROCESS ACCOMPLISHES

1. Water mains cleaned and cement-lined without removing pipe.
2. Eliminates discoloration and further cleaning costs.
3. Reduces pumping costs.
4. Restores reduction in head and flow co-efficients. This means full fire protection and lowered insurance rates.
5. All Joints cement-lined . . . eliminates bacteria in joints.
6. Does the job with minimum interruption of service to consumer.

Write for Literature

TATE PIPE LININGS, Inc.
ANDOVER, MASS.

84" pipe—Spring Lake, N. J.

FLANGED PIPE

FLEXIBLE JOINT PIPE

BELL & SPIGOT PIPE

SPECIAL CASTINGS

SHORT BODY BELL & SPIGOT SPECIALS

Large stock enables us to make prompt shipments.

CAST IRON PIPE

SIZES 2" TO 84"

Warren Foundry & Pipe Corp.
11 Broadway, New York

Warren Pipe Company of Mass., Inc.
75 Federal St., Boston

range of dust and mists. The filter is more porous on the outer side so that the larger dust particles are eliminated first. The new respirator has many other well-known M. S. A. features, including a protective filter cover for preventing contamination of filter through handling. The bulletin states that the respirator is particularly suited for concerns having programs of regular cleaning and maintenance of respirators, as it can be completely disassembled without tools in a few seconds. For additional information about the "Single Filter Dustfoe Respirator" ask for Bulletin CM-5, from Mine Safety Appliance Co., Pittsburgh, Pa.

Bacharach Indicating Instruments provide the subject matter for three finely illustrated bulletins. Indicator Type 2-CP, as described in Bulletin 279, is designed for use on medium and moderately high speed engines and for recording cylinder pressures up to 1800 lb./sq. in. Widely used on Diesel engines, it is also suitable for steam engines, gas engines, compressors, and pumps, and water hammer recordings. Details of the indicator drum, its tension spring, and an unique straight-line mechanism are described in the text. Optional accessories as well as standard tools supplied with each indicator are also listed.

For indicating pressures of high-speed engines, Bulletin 281 recommends the use of Bacharach Type 4-HS Indicators. Over 200 of these indicators are in service, some for the past fifteen years. The indicator draws a complete pressure diagram in one engine cycle. One of the significant features of the Type 4-HS instrument is its use of a cantilever beam spring which makes possible a high frequency recording mechanism that has sufficient movement of writing stylus to produce practical diagrams.

Bulletin 280 contains sketches of numerous adapters available for connecting Premax Indicators to practically all makes of Diesel en-

gines. Many of the adapters are suitable for other Bacharach engine indicators. For copies of any of the above bulletins write to Bacharach Industrial Instrument Company, 7000 Bennett Street, Pittsburgh, Pa.

Vari-Pitched Speed-Changers—as described in a new 20-page bulletin of Allis-Chalmers, are designed to give multiple speed performance to machines that normally have a single, or a few fixed speeds. A cross-section drawing of the unit shows the arrangement of belts and sheaves, and the cantilever idler that keeps the belts at a uniform tension. The unit takes only a minimum of space and may be placed horizontally or vertically. Sizes range from 1 to 75 horsepower. The speed range is stepless and runs as high as 375 per cent, permitting 930 to 3480 r.p.m. with an 1800 r.p.m. motor. Complete design data, operating and inspecting information, and selection tables are given. Photographs of speed-changers attached to various machines are shown. If a copy is desired, ask for Bulletin B6013A, from Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Hobart "Simplified" Arc Welders are described in an attractive new 36 page catalog, generously illustrated with photographs of models, principal parts and accessories. The Hobart welder is itself of 100% welded steel construction. "Multi-range dual control" is featured as the new answer to the problem of volt-ampere adjustment: 1000 combinations of voltage and current are quickly attainable by use of a range wheel and adjuster dial mounted on the face of the control panel. The volt-ampere adjuster may be removed from the machine and carried by the operator on the end of an ordinary lamp extension cord, thus avoiding numerous trips to the machine or the temptation to "get by" without making the required adjustments. A two-page cross-section photograph indicates other special features. For a copy of this catalog write to Hobart Brothers, Troy, Ohio.

Protective Floodlighting is the subject of an illustrated folder just released by the Goodrich Electric Co. Types of floodlights shown are made in accordance with late FBI specifications. Among them is the "elipso standlite," a fixture designed to cast a brilliant light along a property line without illuminating build-

(Continued next page)

DOW
FERRIC CHLORIDE

● SLUDGE CONDITIONING
● SEWAGE COAGULATION
● WATER PURIFICATION

35-47% SOLUTION
Shipped in Tank Cars

60% CRYSTALS
Packed in 300 or 500 lb. Barrels

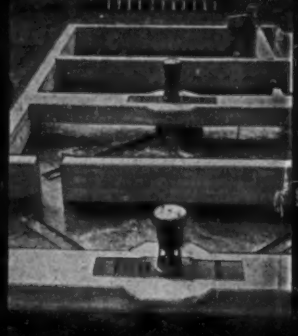
THE DOW CHEMICAL COMPANY
MIDLAND MICHIGAN

INQUIRIES INVITED
on all Problems of
WATER TREATMENT

Whether your problem of water rectification is large or small, we have a form of equipment to serve your needs. We manufacture and install equipment for Gravity Filtration and Softening Plants; Pressure Filters and Zeolite Softeners; Swimming Pool Recirculating Appliances; and Water Treatment Units of all types.

ROBERTS FILTER MFG. CO.
607 COLUMBIA AVE.
DARBY, PA.

AERO-MIX
AERATOR — MIXER



Down-Draft Type MECHANICAL SEWAGE AERATORS

Write for information on AER-O-MIX for your SEWAGE or WATER TREATMENT APPLICATION.

VOGT MFG. CO.
INCORPORATED
P. O. Box 1122 Louisville, Ky.

Over 225 P. F. T. Floating Covers in War Service

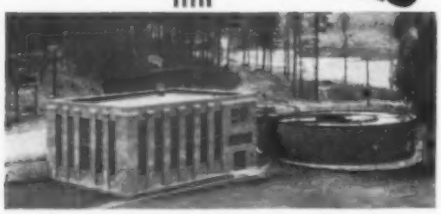
The health of our fighting men and war workers is being safeguarded by modern sewage disposal plants. We are doing our part by delivering on time P.F.T. Floating Covers and other sewage treatment equipment.

The P.F.T. Floating Cover for single and stage digestion hastens the digestion process, and provides for utilizing the sewage gas to heat water for the digester tank.

Catalog No. 232 contains complete information, including specifications. Write for your copy.

P.F.T. PACIFIC FLUSH-TANK CO.
4241 Ravenswood Ave., Chicago, Ill.
New York Charlotte, N. C.

PITTSBURGH • DES MOINES



STEEL FILTRATION PLANTS

Built of welded *steel* at every point in the water-handling sequence: mixing chambers, spiral baffle sedimentation basins, rapid sand filters, clear well units, and storage reservoirs . . . for permanence, water-tightness, low maintenance, and freedom from damage by ground movement or frost. Write now for planning advice on *your* future project!

PITTSBURGH • DES MOINES STEEL COMPANY
Pittsburgh, Pa. . . . . 3412 Neville Island
Des Moines, Ia. . . . . 913 Tuttle Street

ings or grounds. These elliptical floodlights, furnished in both an angle and direct style, enable a watchman to stand in darkness and readily observe an intruder. Fixtures are mounted low, thereby permitting good illumination with lamps from 300 to 500 watts. Two types of portable floodlights are also illustrated. For a copy of the folder write to Goodrich Electric Company, 4600 Belle Plaine Avenue, Chicago, Ill. Ask for Folder No. 101.

EQUIPMENT NEWS

New Economy Pumps

• Economy Pumps, Inc., of Hamilton, Ohio, specialists for the past 30 years in engineering and manufacturing pumps, recently announced a new Economy Pump.

This pump, known as the S.C.V. type, is a motor mounted vertical pump, having capacities of 10 to 500 gpm.

Features of the new S.C.V. pump include such items as a single shaft stuffing box, and simplified lubrication which involves only three greasing points—one on the pump and two on the motor.

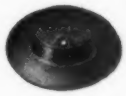
An interesting feature is the ease with which the entire motor assembly

may be removed from the pump case without disturbing the suction or discharge sections. Since the readily accessible impeller is mounted between outboard and inboard bearings on oversized shaft, quiet operation and no-whip long life is assured.

The new S.V.C. pump is fully described and compared with other types in Catalog D2-1042. For a copy write Economy Pumps, Inc., Hamilton, Ohio.

METER BOX COVERS

Ford Meter Box Covers are made in a variety of types and sizes for all conditions. Double-lid covers have air-space insulation and sloping skirts which cut down heat loss to a minimum. Single-lid covers have overlapping lids or inset lids: are made in several depths and lid sizes.



Ford Covers are well made to give a lifetime of satisfaction. All have the exclusive Lifter Worm Lock which has been proved in service. A million Ford Covers are in use. Learn more about Ford Meter Box Covers by writing for our catalog.

FORD METER BOX CO.
WABASH, IND.

For WAR EMERGENCIES

M H

VALVES HYDRANTS
AND WATERWORKS ACCESSORIES

M & H products, including pipe line accessories, are well known for high quality of material and expert workmanship. They are made according to standard specifications and have been used for many years throughout the country. Write for Catalog No. 34.

M & H VALVE AND FITTINGS COMPANY
ANNISTON, ALABAMA

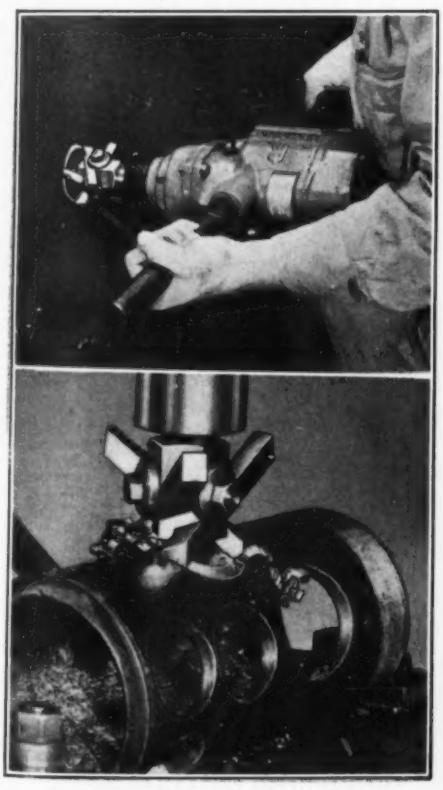
WITH THE MANUFACTURERS

Clark Hole Cutter

• The three blade Clark Adjustable Hole Cutter was just recently introduced on the Pacific Coast by the Robert H. Clark Co. of Los Angeles. Examples of uses for these cutters are pictured above. It is noted that they cut curved surfaces as well as flat.

Clark Hole Cutters are designed for use in electric drills, pneumatic motors, drill presses, lathes, milling machines —wherever Morse Taper or straight shank tools can be used. They will cut clean holes ¾ inch to 4½ inches in diameter in metals, plastics, hard fibers, pressboard or wood in thin sheets or ¾ inch thick plates. No finish grinding or filing is required when holes are cut with this cutter.

For further details and descriptive pamphlet write Robert H. Clark Co., 3424 Sunset Blvd., Los Angeles, Calif.



Dow Gets Double "E" Award A Unique Distinction

• The Dow Chemical Co. of Midland, Mich. now enjoys the unique distinction of holding a double "E" Army-Navy Award for production excellence. The above picture taken during the award ceremonies when Dow received two Army-Navy "E" Awards, shows Major General Wm. N. Porter, Chief of Chemical Warfare Service making the presentation in Midland. Seated from left is James W. Durin, Dow's Personnel Director, C. D. Swain, Naval Inspector of Ordnance and Dr. Willard H. Dow, the president.

One of the world's largest and most important chemical producers, Dow was cited by General Porter for consistent production "in some instances double the normal capacity of the plant."

Bought by Hendy Iron Works of California

Chas. E. Moore

Charles E. Moore, President of Joshau Hendy Iron Works, Sunnydale, California, has announced the purchase of the Pomona Pump Co. of Pomona, Calif., and its recently acquired subsidiary, the Westco Pump Division, St. Louis, Mo. Hendy also purchased the plant and equipment of the Hydril Company, Torrance, Calif. to supplement the facilities available at Pomona.

The purchase of this prominent pump manufacturer, serving the irrigation,

HYDRO-TITE

ONE POUND does the work of four pounds of lead. Much easier to use than lead and requires no caulking.

HYDRO-TITE joints are strong, very flexible and tight.

Write for our free trial offer.

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OVER 25 YEARS WITHOUT A FAILURE

NATIONAL GATE VALVES

You can specify National Gate Valves for Water Works operation with full assurance that their time-tested designs and husky construction will operate with fool-proof dependability. The National line of Water Works and Sewerage specialties is complete . . . special designs developed promptly by our engineering staff.

NATIONAL MACHINE WORKS
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FOR SEWAGE TREATMENT AND WATER SUPPLY . . .

● Venturi Tubes, Weirs, Flumes, Nozzles and other primary elements; Mechanically and Electrically operated Registers and Complete Automatic Control Systems.

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Bailey Meter Co. Ltd., Montreal, Canada

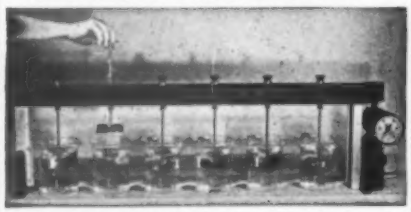
The Meter-Master

RATE RECORDER FOR WATER METERS

Send for Literature

F. S. BRAINARD & CO.
246 Palm Street, Hartford, Conn.

THE *Phipps & Bird* LABORATORY MIXER . . .



IS the important piece of equipment in the Modern Water Works Laboratory. Now being used by leaders in water works research. Many superintendents and chemists have been able to reduce their chemical costs by the control of chemical dosages with this mixer. Write for literature.

PHIPPS & BIRD, INC. **Richmond, Va.**

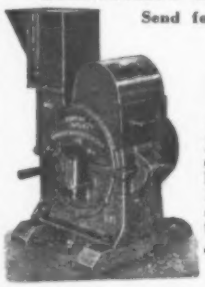
GRUENDLER'S 57th YEAR

SANITARY ENGINEERS

Send for facts on our latest

"NON-CLOG" SEWAGE SHREDDERS

for Municipal Plants



For the disintegration of Rag Stock, Garbage, Floatables, and Fibrous Materials *without Choke Down* so as to pass Screen Bar—

"Gruendler selected by U. S. Navy"

GRUENDLER CRUSHER & PULVERIZER CO.
2917-29 N. Market St., St. Louis, Mo.

mining, water treatment, central station and domestic water supply and sewerage fields, gives the Joshau Hendy Co. an additional complete line in the machinery field. This further rounds out the scope created by the recent purchase of the Crocker-Wheeler Electric Mfg. of Ampere, N. J., prominent half century old builders of electric motors, generators and flexible couplings.

The Pomona Division has been, and will continue to be, principally engaged in the manufacture of turbine pumps of the vertical type for all pumping applications. The Westco Division specializes in smaller sizes for domestic and industrial pumping jobs.

W&T Win Army-Navy "E"

• Just as we are going to press word has come to us that Wallace & Tiernan Co. will soon be flying the Army-Navy "E" pennant of excellence in war production efforts and attainments. And employees of W. & T. will be wearing the prized Army-Navy "E" lapel buttons.

While this issue is in the mails the award ceremonies and presentation of the "E" pennant and employee insignia will be under way in Newark, N. J., on January 25th.

Who Is Fritz Ziebarth?

• In the December issue of WATER WORKS AND SEWERAGE a new ad appeared which had the impelling caption "Who the Hell is Ziebarth?" It was this question that prompted us to make inquiry as to who is this fellow Ziebarth, anyway? Here is in part the answer that we get back—plus the photograph herewith.

That Fritz Ziebarth was a go-getting contractor and builder we got from the ad. What we didn't know was the imposing list of water and sewage projects which have in recent years been put in by Ziebarth Construction, which boasts some 1,700 employees on projects of $5,000,000 value downwards.

Fritz Ziebarth

Fritz Ziebarth, we learned, was born in Minnesota and began as a line foreman at 17. From this point on the story is that of a colorful career of a successful contractor with the West in his veins.

"The Story of Ziebarth Construction" is the title of an interesting brochure which is the reader's for the asking. If you like success stories a copy may be had by dropping a card to Ziebarth Construction, 805 West Esther St., Long Beach, California.

GASKET AND FORM
The Perfected Method for Making SEWER PIPE JOINTS OF CEMENT

- **No jute used—gasket centers spigot.**
- **Definite space in each joint for cement.**
- **Form confines cement-grout to lower portion of joint.**
- **Particularly advantageous in water-bearing trenches.**
- **Infiltration minimized.**

L. A. WESTON **Adams, Mass.**

ANTHRAFILT

A Filter Medium For All Purposes

ANTHRACITE EQUIPMENT CORP.
19 Rector St. New York

H. G. Turner Research Engineer
STATE COLLEGE, PA.

ZECO GREENSAND ZEOLITE

ZECO and HI-ZECO Greensand Zeolite for water softening, filtration and iron removal. ZECO Manganese Zeolite for iron and manganese removal. COREXITE mineral for corrosion control and water stabilization.

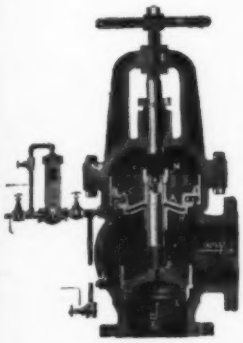
ZEOLITE CHEMICAL CO.
Sales Office 140 Cedar St., New York, N. Y. Factory Medford, N. J.
Pioneer Producer of GREENSAND ZEOLITE MINERAL

SANITARY & MECHANICAL ENGINEER
30 years of experience in research, developing, projection, construction, setting up, maintaining and control of WATER WORKS with piping for water distribution, WATER FILTER and PURIFICATION PLANTS of all kinds, etc. Executive ability. Accustomed to responsibility. Available immediately. **Box 2000,** Water Works & Sewerage, 155 East 44th Street. New York City.

Triple-Acting Non-Return Valve

This valve will automatically cut in a boiler whenever its pressure equals line-header pressure; it will isolate a boiler automatically whenever its pressure, from any cause, is lower than line-header pressure; and it will prevent steam flow from the boiler in event of sudden drop of line-header pressure below the boiler pressure, by means of differential shot pilot valve functioning.

Write for specifications.



Furnished in angle, globe and elbow patterns, sizes 2½" to 12"; also available in larger sizes, as well as in the Cross pattern.

GOLDEN-ANDERSON VALVE SPECIALTY CO.
Fulton Building Pittsburgh, Pa.

Pittsburgh-Nationals' 50 Year Men

• In the Nov.-Dec. issue of *"Water,"* published every other month by Pittsburgh Equitable Meter Co., there appeared a group of pictures of 15 veteran craftsmen serving Pittsburgh-National Meters for 40 years and upwards. As *"Water"* points out, it adds up to "709 years of experience."

The six employees below are the 50 year men of the group, with 50 to 58 years of service to their credit as veteran meter-makers. We can only hope that they may long be meter-makers.

O. W. Trumbull New V. P. and Gen'l Mgr. Green-Tweed & Co.

O. W. Trumbull, formerly of Asbestos Textile Co. has recently joined Green, Tweed & Co., of New York City, assuming the position of General Manager and Vice President of the company.

Mr. Trumbull brings to Green-Tweed many years of experience in the asbestos and packing fields, which will be most helped in the further expansion of this old and well known manufacturers of packings.

W. S. Allen New Josam Vice President

W. S. Allen

• The Josam Manufacturing Co., with main sales and Executive Offices in Cleveland, Ohio, and Manufacturing Division in Michigan City, Ind., announces the appointment of W. S. Allen as Vice President in Charge of Sales and Advertising.

Mr. Allen has been associated with Crane Co. for the past several years as Sales Promotion Manager, and his experience in the industry will be of great value in connection with his new duties.

Before going to Crane, Mr. Allen was associated with the Union Carbide & Carbon Corporation, where his work involved important responsibilities pertaining to many phases of marketing, sales management and advertising.

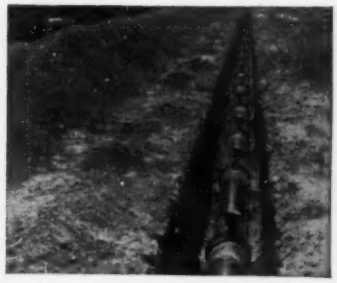
The Josam Co. is a long established and well known plumbing specialty manufacturers including interceptors for oils and grease, swimming pool equipment and shock absorbers (Laundry correctives) for small pipe lines.

LEADITE

The Pioneer Self-Caulking Material for C. I. Pipe

SAVES

all along the line!

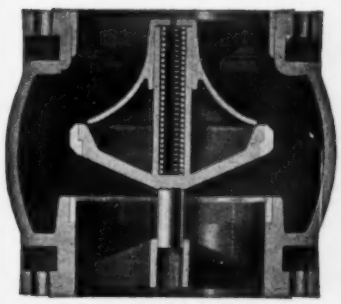


• Widely known and used by Engineers and Water Works men, LEADITE saves in cost of material . . . in caulking charges . . . in digging of large bell holes . . . in cost of trench pumping! Makes a good, tight, lasting joint!

THE LEADITE COMPANY
Girard Trust Co. Bldg., Philadelphia, Pa.

No Caulking

SMOLENSKY VALVES



■ The Smolensky Radialflow Noiseless Check Valve eliminates friction head loss, which assures operating efficiency and noiseless operation.

Designed to be constructed with a cast iron body, plug, spider, and made with a renewal bronze valve seat or seat of other metal when required.

Specify Smolensky Valves for your water works plant and assure yourself years of trouble-free service.

•

Economy—Durability

THE SMOLENSKY VALVE CO.
1931 W. 47th STREET, CLEVELAND, OHIO

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SPECIALIZING IN THE FIELD OF

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Campbell, Davis & Bankson

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Pittsburgh, Pa.

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I. M. Glace
Consulting Sanitary Engineer

WATER SUPPLY AND PURIFICATION
SEWAGE AND SEWAGE TREATMENT

Specializing in Water Quality Problems

Telephone 3-2938 — **22nd and Market Sts. Harrisburg, Pa.**

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1312 Park Building, Pittsburgh, Pa.

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Physical and chemical tests of Sewages, Sludges and Industrial Wastes.
Examinations, tests and reports on treatment processes and equipment. Experts in litigation.
Treatment processes for Industrial Wastes.

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Hackensack, New Jersey
Hackensack 3-2325

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The demonstration that a democracy of free enterprise can outstrip forced regimentation in production and in fighting gives confidence that the American way will long survive.

There is always a minor note—that of the politician and well meaning theorist.

We have seen it manifested in strikes and by the many companies handed an Army-Navy "E" with one hand and an indictment with the other—which has confused the picture for some as to our overall destination.

When our "University of the Overseas" returns, I believe they will bring a stamina and force to our country's affairs that will give us realistic leadership—a leadership that will trust the people and ask and get a fair deal for all classes.

RESEARCH

The work of our Westport Mill staff during the past year reads like a list of critical and strategic materials. Investigations on nickel-chrome iron ores, chromite, manganese, magnesia from sea water, brines and dolomite, and the recovery and re-sizing of abrasives are but a few on this list.

PLANT ENGINEERING

Greatly increased activity of our Plant Engineering Division has resulted in a wide variety of projects in those fields in which we have had specialized experience. Highlights of our work in South America have been the design of two complete plants for alumina production in Brazil and a plant for leaching low-grade nickel ores in Cuba. In this country a number of alumina plant projects utilizing new sources of raw material are being investigated.

ALUMINUM

The vast expansion programs of the Aluminum Company of America and Aluminum Company of Canada have given us another opportunity to serve this swiftly growing industry. Our equipment is being used for classification, thickening and washing at both the red mud and hydrate stations, and is being supplied for red mud calcination plants and an aluminum from alunite plant as well.

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